



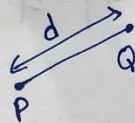
Class 11 Maths || Chapter 10 : Straight Lines || Class Notes

Toppers Village
Class-11-maths Chapter-10
STRAIGHT LINE

Revision COORDINATE GEOMETRY

$P(x_1, y_1)$ $Q(x_2, y_2)$

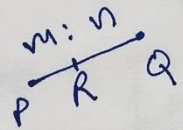
① Distance Formula



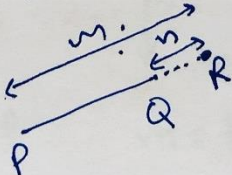
$d = PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

② Section Formula:

Internal Division



External Division



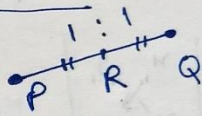
For Internal Division

$R\left(\frac{mx_2 + nx_1}{m+n}, \frac{my_2 + ny_1}{m+n}\right)$ ✓

For External Division

$R\left(\frac{mx_2 - nx_1}{m-n}, \frac{my_2 - ny_1}{m-n}\right)$ ✓✓

Mid Point Formula

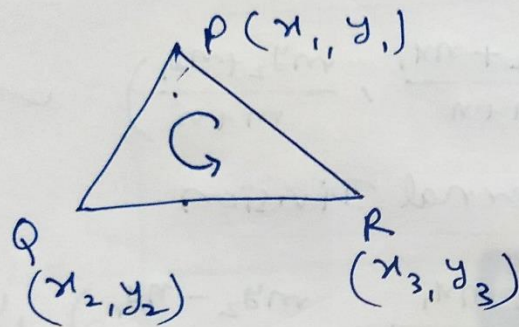


$R\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

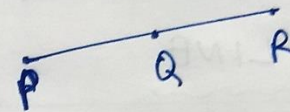
YouTube पर इस Chapter के FREE Videos देखिए (Playlist की Link नीचे है)

<https://www.youtube.com/watch?v=A9LdD72fkpU&list=PLPFrn0ppwwkRhmaizVmQT2glPBEyYcFZs>

Area of a Triangle



Condition for 3 collinear points.



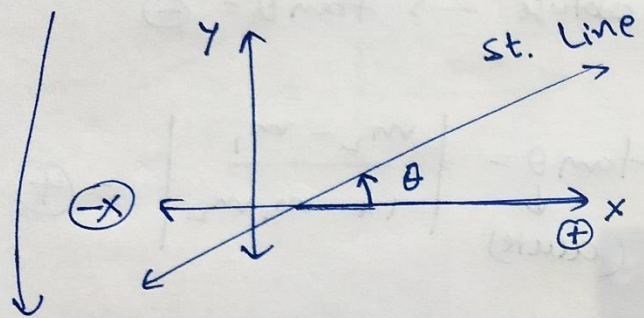
$$\boxed{\text{ar}(\Delta PQR) = 0}$$

$$\text{Area} = A = \Delta = \frac{1}{2} \left| \underline{x_1(y_2 - y_3)} + \underline{x_2(y_3 - y_1)} + \underline{x_3(y_1 - y_2)} \right| \neq 0$$

$$\frac{1}{2} \begin{vmatrix} x_1 & y_1 \\ x_2 & y_2 \\ x_3 & y_3 \end{vmatrix} = \frac{1}{2} \left((x_1 y_2 + x_2 y_3 + x_3 y_1) - (x_2 y_1 + x_3 y_2 + x_1 y_3) \right)$$

$$\frac{1}{2} \left(+ \text{⌚} - \text{⌚} \right)$$

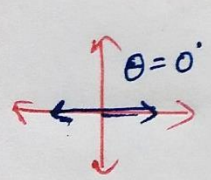
Inclination. = θ = Angle



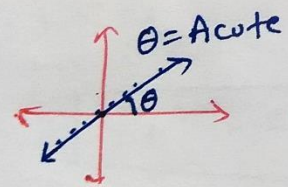
angle measured between
positive x-axis and
straight line in anti-
Clockwise Direction.

Slope: $m = \tan \theta$ ★

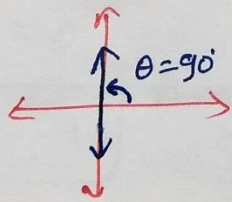
s	AI
t	c



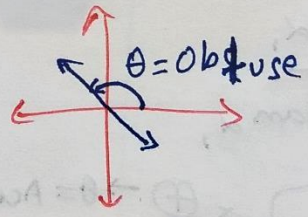
$m = \tan 0^\circ$
 $m = 0$



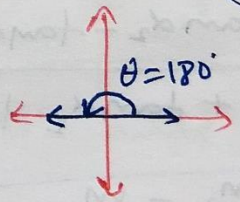
$m = \tan \theta$
 $= (+)$



$m = \tan 90^\circ$
 $m \rightarrow \infty$

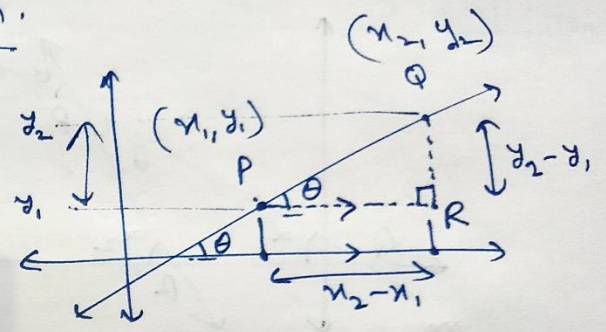


$m = \tan \theta$
 $= (-)$



$m = \tan 180^\circ$
 $m = 0$

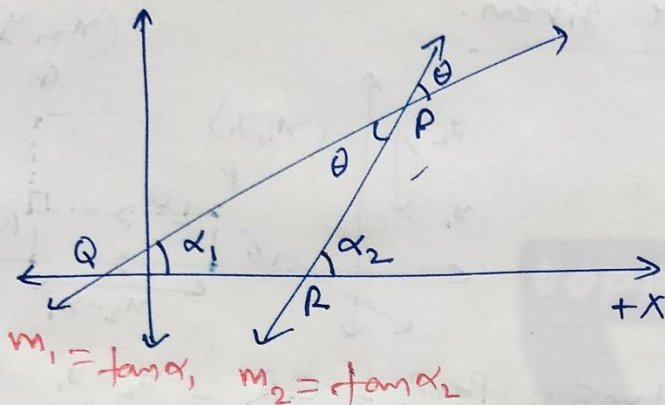
when two points on a line
are given.



$$m = \tan \theta = \frac{\text{Perp.}}{\text{Base}} = \frac{QR}{PR} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \text{Slope} \quad \star$$

Angle between two lines. = θ



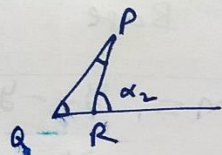
$\theta = \text{acute} \rightarrow \tan \theta = \oplus$

$\theta = \text{obtuse} \rightarrow \tan \theta = \ominus$

$$\left\{ \begin{array}{l} \tan \theta = \left| \frac{m_2 - m_1}{1 + m_1 m_2} \right| = \oplus \\ \quad \downarrow \\ \quad \text{(acute)} \\ \text{obtuse} = 180 - \theta \end{array} \right.$$

Exterior Angle:

$$\alpha_2 = \alpha_1 + \theta$$



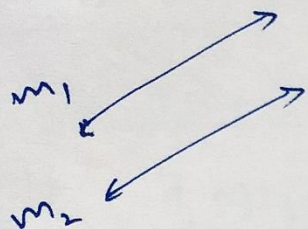
$$\theta = \alpha_2 - \alpha_1$$

$$\Rightarrow \tan(\theta) = \tan(\alpha_2 - \alpha_1)$$

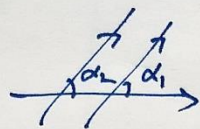
$$\Rightarrow \tan \theta = \frac{\tan \alpha_2 - \tan \alpha_1}{1 + \tan \alpha_2 \cdot \tan \alpha_1}$$

$$\Rightarrow \boxed{\tan \theta = \frac{m_2 - m_1}{1 + m_2 m_1}} \begin{cases} \oplus \rightarrow \theta = \text{Acute} \\ \ominus \rightarrow \theta = \text{obtuse} \end{cases}$$

Condition of Parallel lines

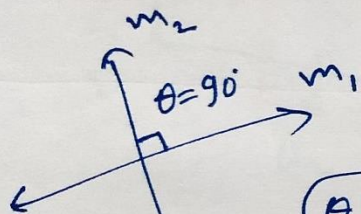


$$m_1 = m_2$$



$$\theta = 0^\circ, \theta = 180^\circ$$

Condition of Perpendicular Lines



$$\tan \theta = \frac{m_2 - m_1}{1 + m_1 m_2}$$

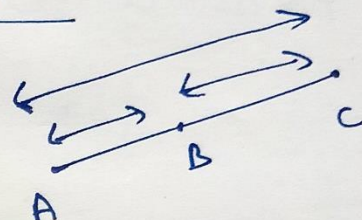
$$\theta = 90^\circ$$

$$\frac{1}{0} = \infty = \tan 90^\circ = \frac{m_2 - m_1}{1 + m_1 m_2} \rightarrow 0$$

$$\Rightarrow 1 + m_1 m_2 = 0$$

$$m_1 m_2 = -1$$

Condition for 3-collinear Points



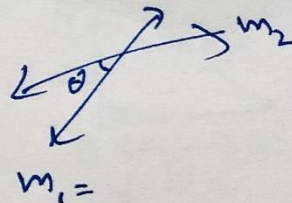
$$\textcircled{1} \ar(\triangle ABC) = 0$$

$$\textcircled{2} m_{AB} = m_{BC} = m_{AC}$$

e.g.

$$m_1 = \frac{1}{2}$$

$$m_2 = \frac{1}{3}$$



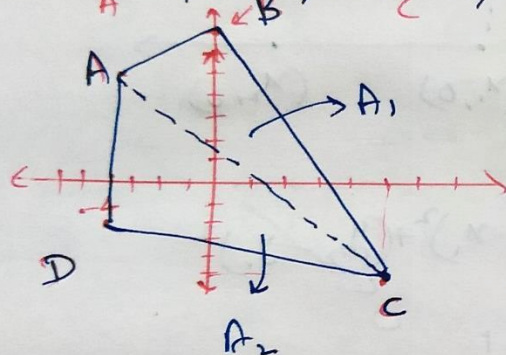
find angle b/w them = ?

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Class-11-Maths. Straight line

Exercise-10.1

Q.1 $(-4, 5), (0, 7), (5, -5), (-4, -2)$



total area = $A_1 + A_2$ ✓

Short cut:

$$\begin{array}{c|c} \text{A} & -4 \times 5 \\ \text{B} & 0 \times 7 \\ \text{C} & 5 \times -5 \\ \text{D} & -4 \times -2 \\ \textcircled{\text{A}} & -4 \times 5 \end{array}$$

→ →

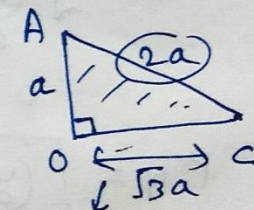
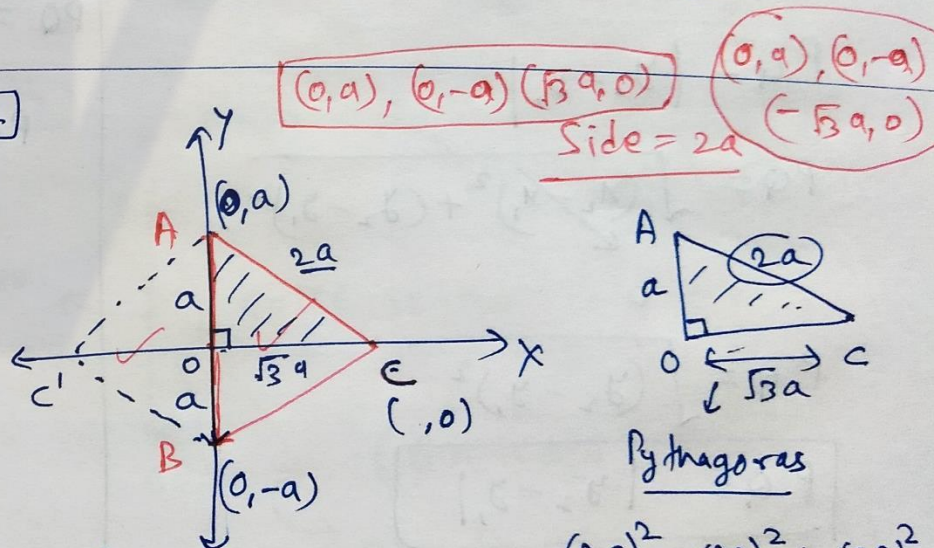
$$\text{Area} = \frac{1}{2} \left| \begin{array}{c} (-28 + 0 - 10 - 20) \\ - (0 + 35 + 20 + 8) \end{array} \right|$$

$$= \frac{1}{2} | -58 - 63 |$$

$$= \frac{1}{2} | -121 |$$

$$= \frac{1}{2} \times 121 = \frac{121}{2} = 60\frac{1}{2} \text{ Sq. units.}$$

Q.2



Pythagoras

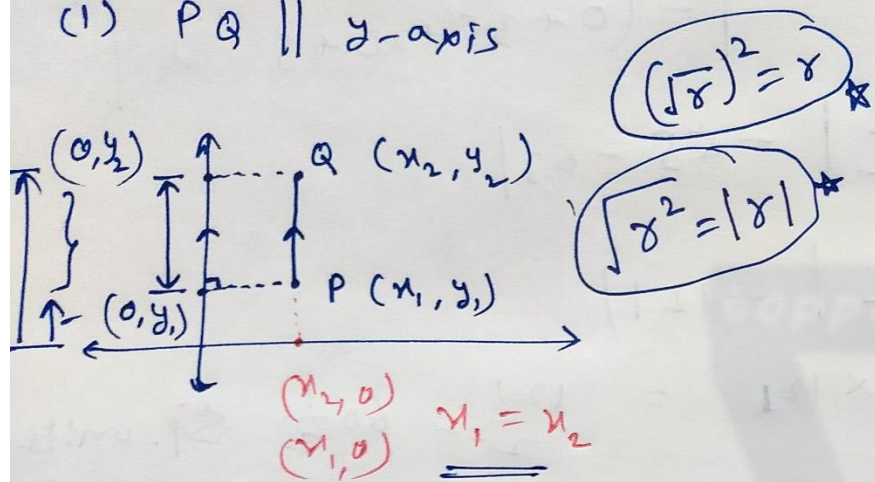
$$(2a)^2 = (AO)^2 + (OC)^2$$

$$OC = \sqrt{3}a \rightarrow C(\sqrt{3}a, 0) \Rightarrow 4a^2 = a^2 + OC^2$$

$$C' = (-\sqrt{3}a, 0) \Rightarrow \boxed{3a^2 = OC^2}$$

Q.3 $P(x_1, y_1)$ $Q(x_2, y_2)$

(i) $PQ \parallel y\text{-axis}$



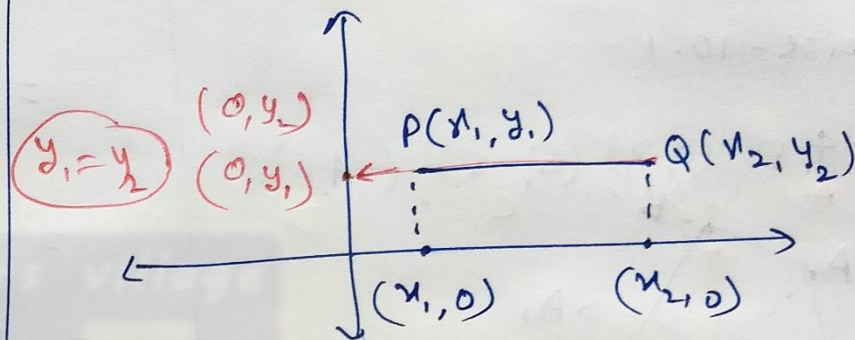
$$PQ = |y_2 - y_1|$$

$$PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$PQ = \sqrt{(y_2 - y_1)^2}$$

$$\boxed{PQ = |y_2 - y_1|}$$

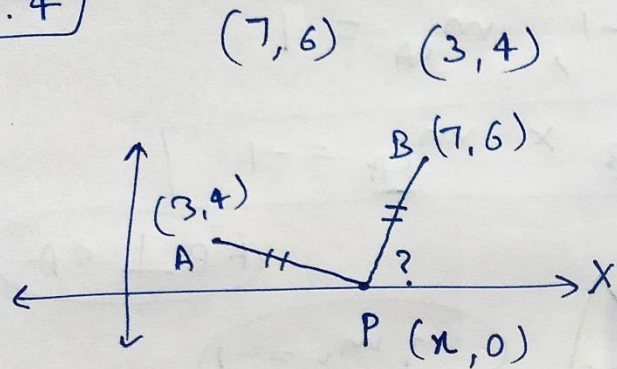
(ii) $PQ \parallel x\text{-axis}$



$$PQ = QP = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$PQ = |x_2 - x_1|$$

Q.4



Equidistant. $PA = PB$

$$\Rightarrow \sqrt{(x-3)^2 + (0-4)^2} = \sqrt{(x-7)^2 + (0-6)^2}$$

$$\Rightarrow x^2 - 6x + 9 + 16 = x^2 + 49 - 14x + 36$$

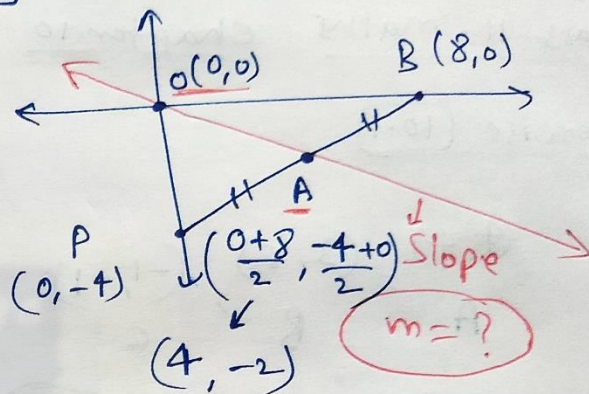
$$\Rightarrow 14x - 6x = 49 + 36 - 25$$

$$\Rightarrow 8x = 24 + 36$$

$$\Rightarrow 8x = 60$$

$$\boxed{x = \frac{15}{2}} \quad \underline{\underline{P\left(\frac{15}{2}, 0\right) \checkmark}}$$

Q.5



$$O(0, 0) \rightarrow (x_1, y_1)$$

$$A(4, -2) \rightarrow (x_2, y_2)$$

$$\checkmark m = \tan \theta$$

$$\checkmark m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m_{OA} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m_{OA} = \frac{(-2) - (0)}{(4) - (0)} = \frac{-2}{4} = -\frac{1}{2}$$

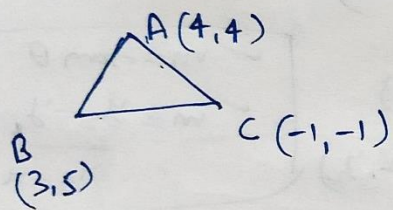
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Class-11-Maths Chapter-10

Exercise 10.1

Q.6

$(4, 4)$, $(3, 5)$, $(-1, -1)$
A, B, C

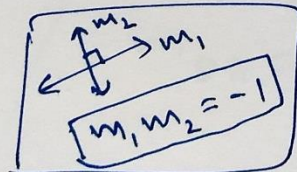
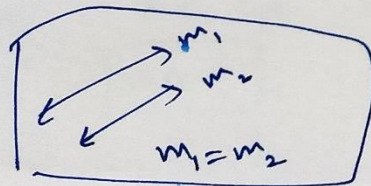


$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m_{AB} = \frac{5-4}{3-4} = \frac{1}{-1} = -1 \checkmark$$

$$m_{BC} = \frac{-1-5}{-1-3} = \frac{-6}{-4} = \frac{3}{2}$$

$$m_{CA} = \frac{4-(-1)}{4-(-1)} = \frac{5}{5} = 1 \checkmark$$

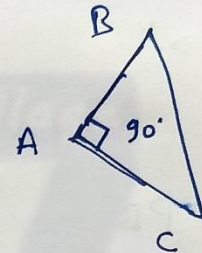


$$\therefore m_{AB} = -1, m_{CA} = 1$$

$$\therefore m_{AB} \times m_{CA} = -1$$

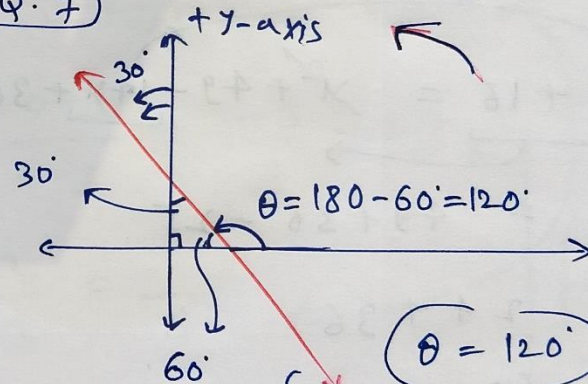
$$AB \perp CA$$

$$m_1 m_2 = -1$$



$\therefore \triangle ABC \rightarrow$ Right Angled Δ .

Q.7



Slope $m \rightarrow m = \tan \theta$

+ x-axis
Anticlockwise

$$\theta = 120^\circ$$

$$m = \tan \theta = \tan 120^\circ$$

$$m = -\sqrt{3}$$

Q.8

A (1, -1) B (2, 1) C (4, 5)

Collinear



Slope = Same

$$m_{AB} = m_{BC}$$

$$\text{ar}(\Delta ABC) = 0$$

$$\Rightarrow \frac{-1 - 1}{1 - 2} = \frac{5 - 1}{4 - 2}$$

$$\Rightarrow \frac{-2}{1 - 2} = \frac{4}{2}$$

$$\Rightarrow -2 = 2(1) - 4$$

$$\Rightarrow 4 - 2 = 2(1)$$

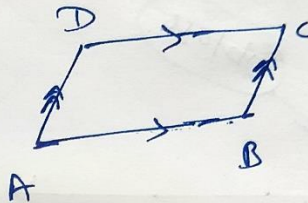
$$\Rightarrow 2 = 2(1)$$

$$\boxed{1 = 1}$$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Q.9

A (-2, -1) B (4, 0) C (3, 3) D (-3, 2)



Concept
 $m_1 = m_2$
 Parallel

$$m_{AB} = m_{DC}$$

$$m_{AD} = m_{BC}$$

$$m_{AB} = \frac{-1 - 0}{-2 - 4} = \frac{-1}{-6} = \frac{1}{6}$$

$$m_{BC} = \frac{0 - 3}{4 - 3} = \frac{-3}{1} = -3$$

$$m_{CD} = \frac{3 - 2}{3 - 3} = \frac{1}{0}$$

$$m_{DA} = \frac{-1 - 2}{-2 - 3} = \frac{-3}{-5} = \frac{3}{5}$$

$$m_{AB} = m_{CD} \rightarrow AB \parallel CD$$

$$m_{BC} = m_{DA} \rightarrow BC \parallel DA$$

Q.8

A (1, -1) B (2, 1) C (4, 5)

Collinear



Slope = Same

$$m_{AB} = m_{BC}$$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$\text{ar}(\Delta ABC) = 0$$

$$\Rightarrow \frac{-1 - 1}{1 - 2} = \frac{5 - 1}{4 - 2}$$

$$\Rightarrow \frac{-2}{1 - 2} = \frac{4}{2}$$

$$\Rightarrow -2 = 2 - 4$$

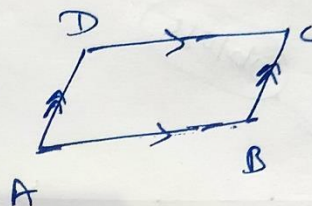
$$\Rightarrow 4 - 2 = 2$$

$$\Rightarrow 2 = 2$$

$$\boxed{x = 1}$$

Q.9

A (-2, -1) B (4, 0) C (3, 3) D (-3, 2)



Concept

$$\begin{matrix} \leftarrow m_1 \\ \leftarrow m_2 \end{matrix} \quad \boxed{m_1 = m_2}$$

Parallel

$$m_{AB} = m_{DC}$$

$$m_{AD} = m_{BC}$$

$$m_{AB} = \frac{-1 - 0}{-2 - 4} = \frac{-1}{-6} = \frac{1}{6}$$

$$m_{BC} = \frac{0 - 3}{4 - 3} = \frac{-3}{1} = -3$$

$$m_{CD} = \frac{3 - 2}{3 - 4} = \frac{1}{-1} = -1$$

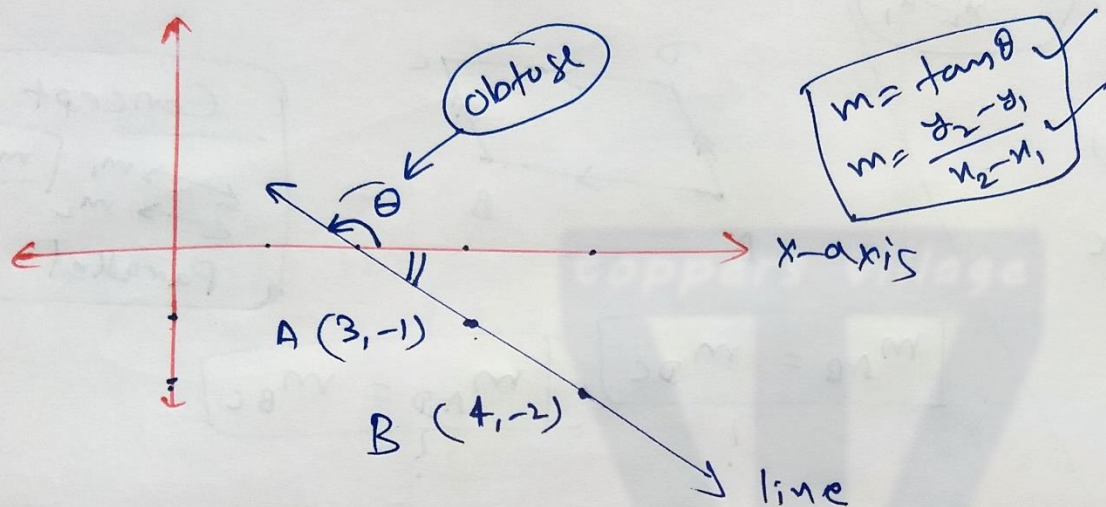
$$m_{DA} = \frac{-1 - 2}{-2 - 3} = \frac{-3}{-5} = \frac{3}{5}$$

$$m_{AB} = m_{CD} \rightarrow AB \parallel CD$$

$$m_{BC} = m_{DA} \rightarrow BC \parallel DA$$

Q.10

line joining $(3, -1)$ & $(4, -2)$



$$m = m_{AB} = \frac{(-1) - (-2)}{(3 - 4)} = \frac{-1 + 2}{-1} = \frac{1}{-1} = -1$$

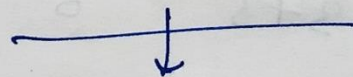
$$m = m_{AB} = \tan \theta$$

$$\therefore \tan \theta = -1$$

$$\Rightarrow \boxed{\theta = 135^\circ}$$

Angle b/w

x-axis & line(AB)



135° or 45°

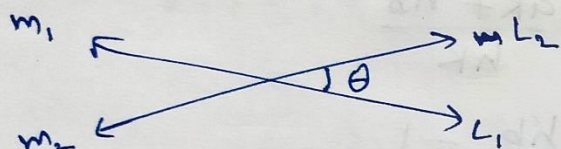
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Class -11- Maths Straight Lines

Exercise 10.1

Q.11 Line₁ → $m_1 = m$

Line₂ → $m_2 = 2m$

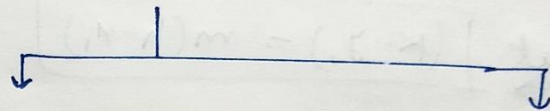


$$\tan \theta = \frac{1}{3}$$

$$\tan \theta = \left| \frac{m_2 - m_1}{1 + m_1 m_2} \right|$$

$$\Rightarrow \frac{1}{3} = \left| \frac{2m - m}{1 + m \cdot 2m} \right|$$

$$\Rightarrow \frac{1}{3} = \left| \frac{m}{1 + 2m^2} \right|$$



$$\frac{m}{1 + 2m^2} = \frac{1}{3}$$

$$\frac{m}{1 + 2m^2} = -\frac{1}{3}$$

$$\Rightarrow 3m = 1 + 2m^2$$

$$\Rightarrow 2m^2 - 3m + 1 = 0$$

$$\Rightarrow \underbrace{2m^2 - m}_{=0} - \underbrace{2m + 1}_{=0}$$

$$\Rightarrow m(2m-1) - 1(2m-1) = 0$$

$$\Rightarrow (m-1)(2m-1) = 0$$

$$m = 1$$

$$m = \frac{1}{2}$$

$$\Rightarrow 3m = -1 - 2m^2$$

$$\Rightarrow 2m^2 + 3m + 1 = 0$$

$$\Rightarrow 2m^2 + m + 2m + 1 = 0$$

$$\Rightarrow$$

$$\Rightarrow (m+1)(2m+1) = 0$$

$$m = -1$$

$$m = -\frac{1}{2}$$

$m \leftarrow m_1$	1	$\frac{1}{2}$	-1	$-\frac{1}{2}$
$2m \leftarrow m_2$	2	1	-2	-1

Q.12

(x_1, y_1) (h, k)

Slope = m ✓

Show that $(k - y_1) = m(h - x_1)$

Proof:

$$\text{Slope} = m = \frac{k - y_1}{h - x_1}$$

$$\Rightarrow m(h - x_1) = (k - y_1) \quad \checkmark$$

$$\Rightarrow \frac{b}{a-h} = \frac{k-b}{-a}$$

$$\frac{a}{h} + \frac{b}{k} = 1$$

$$\Rightarrow -ab = (a-h) \cdot (k-b)$$

$$\Rightarrow -ab = ak - \cancel{ab} - \cancel{hk} + hb$$

$$\Rightarrow 1 \times hk = ak + hb$$

$$\Rightarrow 1 = \frac{ak + hb}{hk}$$

$$\Rightarrow \frac{ak}{hk} + \frac{hb}{hk} = 1$$

$$\Rightarrow \frac{a}{h} + \frac{b}{k} = 1$$

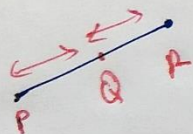
H.P.

~~Q.13~~

Q.13

$(h, 0)$, (a, b) , $(0, k)$

lie on a line.

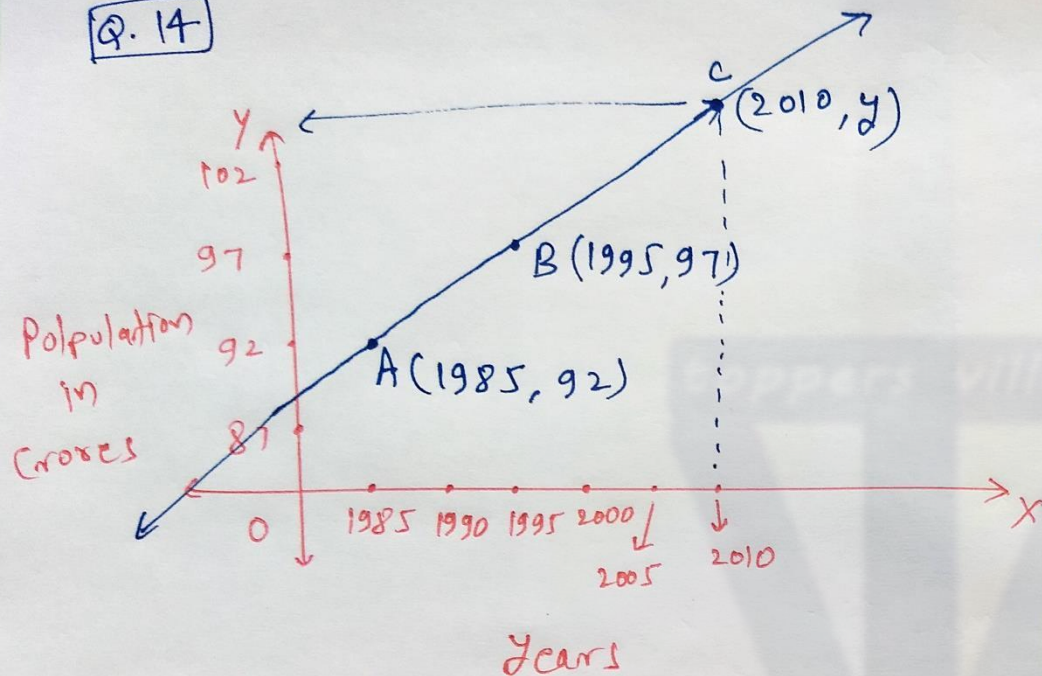


$$m_{PQ} = m_{QR}$$

$$\Rightarrow \frac{b-0}{a-h} = \frac{k-b}{0-a}$$

$$\Rightarrow \frac{b}{a-h} = \frac{k-b}{-a}$$

Q. 14



$$\text{Slope} = m = m_{AB} = \frac{97-92}{1995-1985}$$

$$= \frac{5}{10}$$

$$\text{Slope} = \frac{1}{2} = m_{AB}$$

Population in 2010?

$\therefore A, B, C \rightarrow \text{Collinear}$

$$\Rightarrow m_{AB} = m_{BC}$$

$$\Rightarrow \frac{1}{2} = \frac{y-97}{2010-1995}$$

$$\Rightarrow \frac{1}{2} = \frac{y-97}{15}$$

$$\Rightarrow 15 = 2y - 194$$

$$\Rightarrow 15 + 194 = 2y$$

$$\Rightarrow 2y = 209$$

$$\Rightarrow \boxed{y = 104.5}$$

Population in 2010 = 104.5 crores

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Class - II - Maths Straight Line

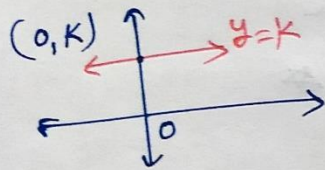
Different forms of Straight Lines

Slope $m = \tan \theta$ ✓

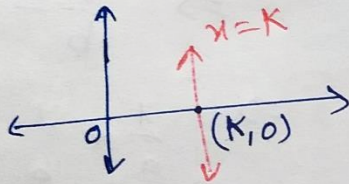
$$m = \frac{y_2 - y_1}{x_2 - x_1} \quad \checkmark$$

(I) Horizontal & Vertical lines.

↓
 $y = k$



↓
 $x = k$

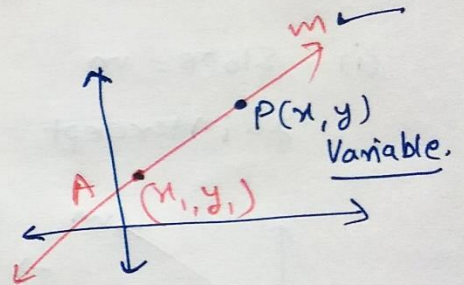


(II) Point - Slope form : →

Given: point located on the st. line.
Slope of the st. line.

Point (x_1, y_1)

Slope = m



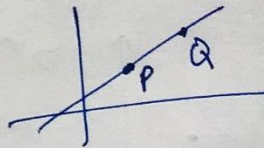
$$\text{Slope} = m = \frac{y - y_1}{x - x_1}$$

$$\Rightarrow \boxed{y - y_1 = m(x - x_1)} \quad \star$$

(III) 2-point form:

Given 2 points on the line.
 (x_1, y_1) & (x_2, y_2) ✓

$$\boxed{(y - y_1) = \left(\frac{y_2 - y_1}{x_2 - x_1} \right) \cdot (x - x_1)}$$



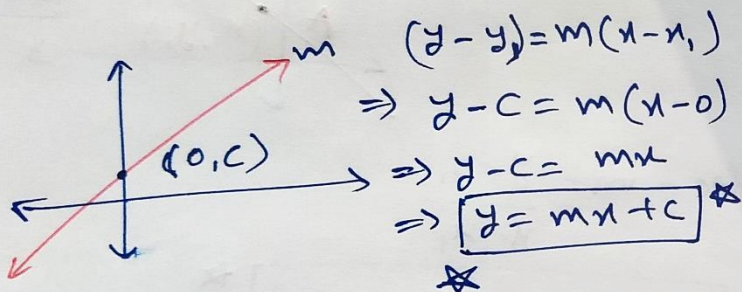
④ Slope Intercept form:

Given: Slope = m

intercept $\rightarrow$ x -intercept = d
 y -intercept = c

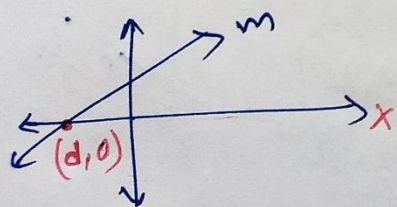
(i) Slope = m

y -intercept = c



(ii) Slope = m

x -intercept = d



$$y - y_1 = m(x - x_1)$$

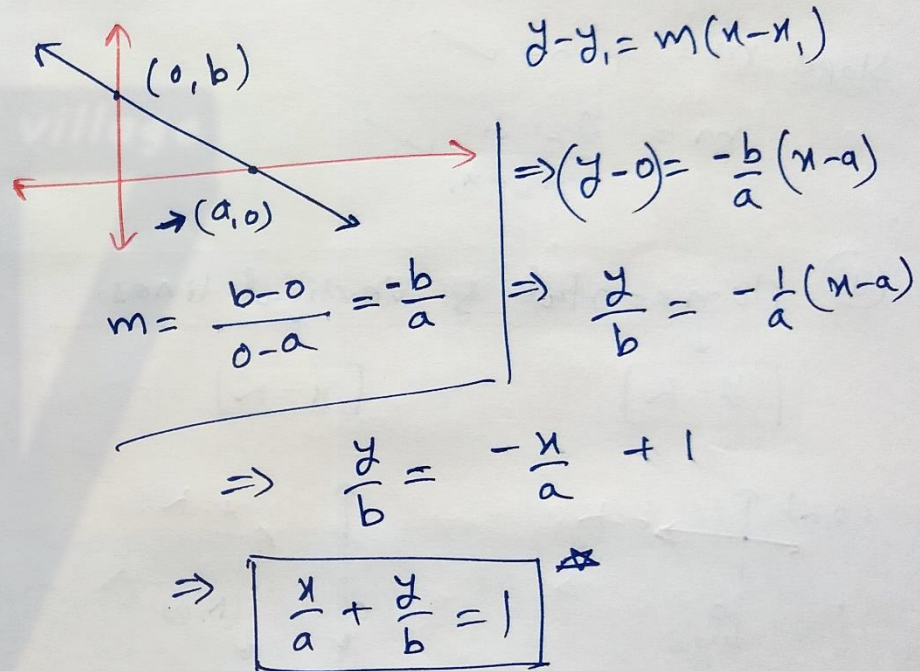
$$y - 0 = m(x - d)$$

$$\boxed{y = m(x - d)}$$

⑤ Intercept form:

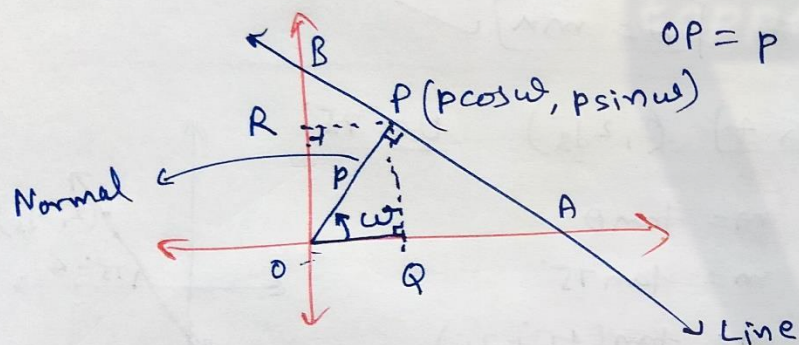
Given: x -intercept = a

y -intercept = b



VI Normal Form: Normal $\rightarrow$ Perpendicular drawn

- Given: (i) length of normal drawn from origin to the line. = p
 (ii) angle made between normal & $\oplus$ x-axis in anti-clockwise direction. = ω



$$\triangle OPQ: \cos \omega = \frac{OQ}{OP} = \frac{OQ}{p}$$

$$\Rightarrow \boxed{OQ = p \cdot \cos \omega}$$

$$\sin \omega = \frac{PQ}{OP} = \frac{RO}{p}$$

$$\Rightarrow \boxed{RO = p \cdot \sin \omega}$$

$OP \perp AB$

$$\Rightarrow \boxed{m_{OP} \cdot m_{AB} = -1}$$

$$\Rightarrow \tan \omega \cdot m_{AB} = -1$$

$$\Rightarrow \boxed{m_{AB} = -\frac{1}{\tan \omega}}$$

$$\Rightarrow \boxed{m_{AB} = -\frac{\cos \omega}{\sin \omega}}$$

$$\text{AB} \rightarrow m_{AB} \quad \boxed{y - y_1 = m(x - x_1)}$$

$$\Rightarrow y - p \sin \omega = \frac{-\cos \omega}{\sin \omega} (x - p \cos \omega)$$

$$\Rightarrow \sin \omega \cdot y - p \sin^2 \omega = -x \cos \omega + p \cos^2 \omega$$

$$\Rightarrow x \cos \omega + y \sin \omega = p (\cos^2 \omega + \sin^2 \omega)$$

$$\Rightarrow \boxed{x \cos \omega + y \sin \omega = p}$$

Horizontal line $y = k$

vertical line $x = k$

* Point slope form $(y - y_1) = m(x - x_1)$

Two point form $y - y_1 = \left(\frac{y_2 - y_1}{x_2 - x_1} \right) (x - x_1)$

Slope intercept form $\begin{matrix} y = mx + c \\ y = m(x - d) \end{matrix} \begin{matrix} * \\ x \end{matrix}$

Intercept form $\frac{x}{a} + \frac{y}{b} = 1$

Normal form $x \cos \omega + y \sin \omega = p$

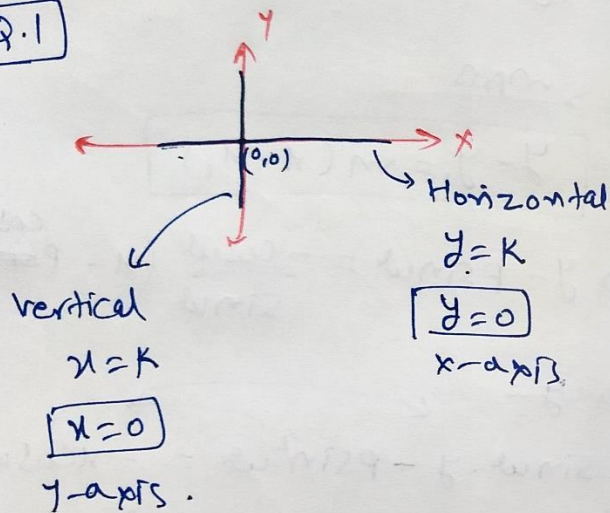
$$\begin{aligned} m &= \tan \theta \\ m &= \frac{y_2 - y_1}{x_2 - x_1} \end{aligned}$$

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Class 11 - Maths Straight Lines

Exercise - 10.2

Q.1



Q.2 Passing through $(-4, 3)$
with slope $\frac{1}{2}$.
↑
Point

By point slope form: ✓

$$(y-3) = \frac{1}{2}(x-(-4))$$
$$\Rightarrow y-3 = \frac{x}{2} + 2 \Rightarrow \boxed{y = \frac{x}{2} + 5}$$

Q.3 Passing through $(0,0)$
with slope $=m$.

By point slope form:

$$\Rightarrow (y-0) = m(x-0)$$

$$\Rightarrow \boxed{y = mx} \checkmark$$

Q.4 $(2, 2\sqrt{3})$ $\theta = 75^\circ$

$$m = \tan \theta$$

$$m = \tan 75^\circ$$

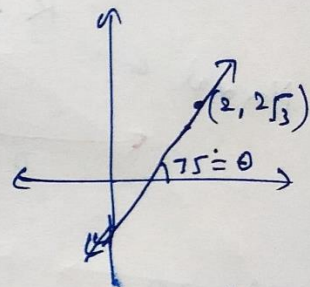
$$m = \tan(45^\circ + 30^\circ)$$

$$m = \frac{\tan 45^\circ + \tan 30^\circ}{1 - \tan 45^\circ \cdot \tan 30^\circ} = \frac{1 + \frac{1}{\sqrt{3}}}{1 - \frac{1}{\sqrt{3}}}$$

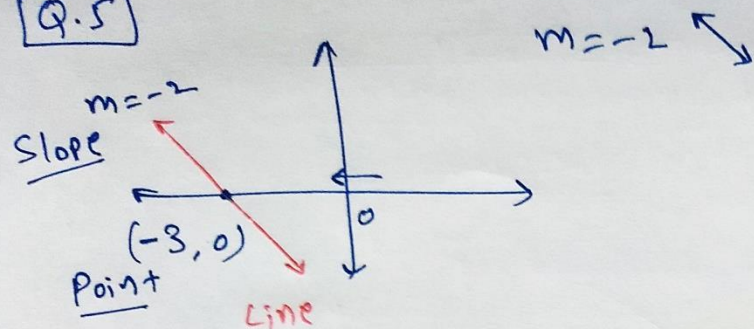
$$m = \frac{\sqrt{3} + 1}{\sqrt{3} - 1}$$

By Point Slope form:

$$(y - 2\sqrt{3}) = \left(\frac{\sqrt{3} + 1}{\sqrt{3} - 1} \right) (x - 2)$$



Q.5



By Point Slope form:

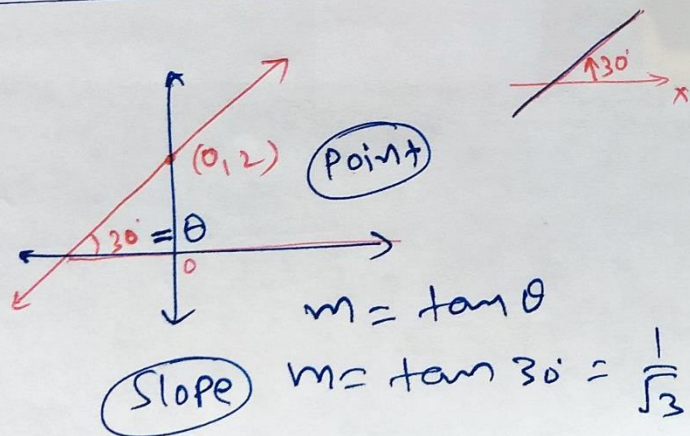
$$(y - y_1) = m(x - x_1)$$

$$\Rightarrow (y - 0) = -2(x - (-3))$$

$$\Rightarrow \boxed{y = -2x - 6}$$

$$\Rightarrow \boxed{2x + y + 6 = 0}$$

Q.6



Point Slope form: $(0, 2)$

$$(y - 2) = \frac{1}{\sqrt{3}}(x - 0)$$

$$\Rightarrow \boxed{\sqrt{3}y - 2\sqrt{3} = x}$$

Q.7

Passing through $(-1, 1)$ & $(2, -4)$

Two Point form:

$$(y - 1) = \left(\frac{-4 - 1}{2 - (-1)} \right) \cdot (x - (-1))$$

$$\Rightarrow (y - 1) = \left(\frac{-5}{3} \right) (x + 1)$$

$$\Rightarrow 3y - 3 = -5x - 5$$

$$\Rightarrow \boxed{3y + 5x + 2 = 0}$$

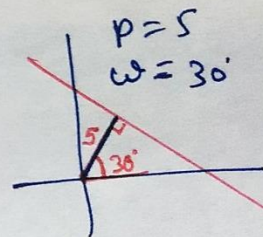
Q.8 By normal form

$$x \cos \omega + y \sin \omega = p$$

$$\Rightarrow x \cos 30^\circ + y \sin 30^\circ = 5$$

$$\Rightarrow \frac{\sqrt{3}}{2}x + \frac{y}{2} = 5$$

$$\Rightarrow \boxed{\sqrt{3}x + y = 10}$$



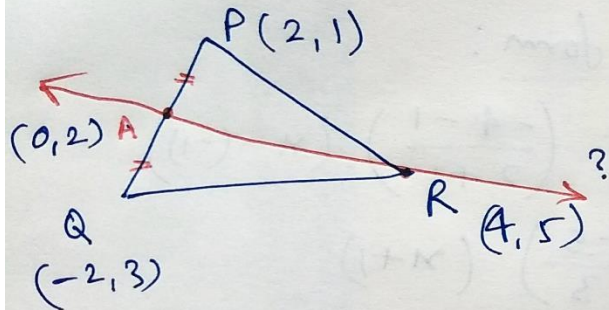
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Class - 11 - Maths STRAIGHT LINES

Exercise - 10.2

Q.9 $P(2,1)$, $Q(-2,3)$, $R(4,5)$

(AR) Median through R = ?



A is mid point of PQ

$$\Rightarrow A \left(\frac{2+(-2)}{2}, \frac{1+3}{2} \right) \equiv A(0,2)$$

$$m = \text{slope of AR} = \frac{5-2}{4-0} = \frac{3}{4}$$

By point slope form $\rightarrow$

$$(y-5) = \frac{3}{4}(x-4)$$

$$\Rightarrow 4(y-5) = 3(x-4)$$

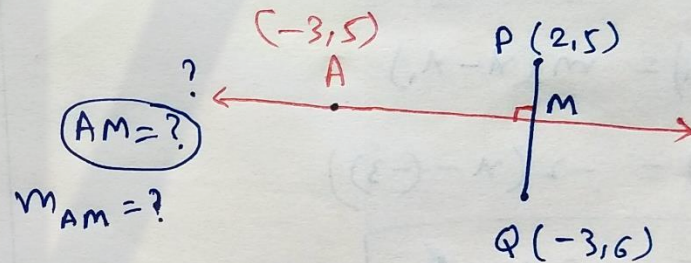
$$\Rightarrow 4y - 20 = 3x - 12$$

$$\Rightarrow \boxed{4y = 3x + 8}$$

Q.10

A
 $(-3,5)$

P
 $(2,5)$, Q
 $(-3,6)$



$$m_{PQ} = \frac{6-5}{-3-2} = \frac{1}{-5}$$

$\therefore AM \perp PQ$

$$\Rightarrow \boxed{m_{AM} \cdot m_{PQ} = -1}$$

$$\Rightarrow m_{AM} \cdot \left(+\frac{1}{5} \right) = -1$$

$$\Rightarrow \boxed{m_{AM} = 5}$$

$$m_1 \cdot m_2 = -1$$

By Point slope form.

(AM) $\rightarrow$

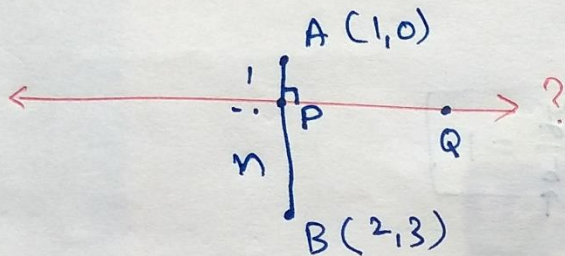
$$(y-5) = 5(x-(-3))$$

$$\Rightarrow y-5 = 5(x+3)$$

$$\Rightarrow y-5 = 5x+15$$

Q.11

$$\frac{(1,0)}{(A)} \quad \frac{(2,3)}{(B)} \quad 1:n$$



PQ = ?

Point
↓
(P)

slope
↓
 m_{PQ}

$AB \perp PQ$

$$\Rightarrow m_{AB} \cdot m_{PQ} = -1$$

$$\Rightarrow \left(\frac{3-0}{2-1} \right) \cdot m_{PQ} = -1$$

$$\Rightarrow \left(\frac{3}{1} \right) \cdot m_{PQ} = -1$$

$$\Rightarrow m_{PQ} = -\frac{1}{3}$$

$$PQ \rightarrow \text{Point } P \left(\frac{2+n}{1+n}, \frac{3}{1+n} \right) \checkmark$$

$$\rightarrow \text{slope} = m = -\frac{1}{3} \checkmark$$

Equation (By Point-slope form)

$$y - y_1 = m(x - x_1)$$

$$\Rightarrow \left(y - \frac{3}{1+n} \right) = -\frac{1}{3} \left(x - \frac{2+n}{1+n} \right) \checkmark$$

For Point 'P' $\rightarrow$ Section formula.

$$\begin{array}{c} 1:n \\ A \quad P \quad B \\ (1,0) \quad (2,3) \end{array} \rightarrow P \left(\frac{1 \times 2 + n \times 1}{1+n}, \frac{1 \times 3 + n \times 0}{1+n} \right) \equiv P \left(\frac{2+n}{1+n}, \frac{3}{1+n} \right)$$

Q.12 → equal intercepts on axes ✓

→ Passes through (2,3)

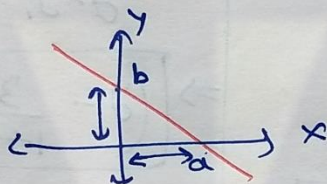
By intercept form:

Let equation of the line be

$$\boxed{\frac{x}{a} + \frac{y}{b} = 1}$$

x-intercept = a

y-intercept = b



ATQ

$$\boxed{a=b}$$

$$\Rightarrow \frac{x}{a} + \frac{y}{a} = 1$$

$$\Rightarrow \frac{x+y}{a} = 1$$

$$\Rightarrow \boxed{x+y=a}$$

Also this line passes through (2,3)

$$2+3=a$$

$$\Rightarrow \boxed{5=a}$$

$$\therefore \text{Eq. of line} \equiv \boxed{x+y=5} \Leftarrow$$

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Class-11-Maths STRAIGHT LINE

Exercise - 10.2

Q. 13 Point (2, 2)

Sum of intercepts = 9

intercept
↓
form

Let the eqⁿ. of line be $\boxed{\frac{x}{a} + \frac{y}{b} = 1}$

a = x-intercept

b = y-intercept

$$a + b = 9 \quad (1) \quad (2, 2)$$

$$a = 9 - b \quad \rightarrow \quad \frac{2}{a} + \frac{2}{b} = 1 \quad (2)$$

By eqⁿ (1) & (2):

$$\Rightarrow \frac{2}{9-b} + \frac{2}{b} = 1$$

$$\Rightarrow \frac{\cancel{2b} + 18 - \cancel{2b}}{(9-b)(b)} = 1$$

$$\Rightarrow \frac{18}{9b - b^2} = 1$$

$$\Rightarrow 18 = 9b - b^2$$

$$\Rightarrow b^2 - 9b + 18 = 0$$

$$\Rightarrow \underbrace{b^2 - 3b} - \underbrace{6b + 18} = 0$$

$$\Rightarrow b(b-3) - 6(b-3) = 0$$

$$\Rightarrow (b-3)(b-6) = 0$$

$$\downarrow \quad \downarrow$$
$$b=3 \quad b=6$$

$$\rightarrow \boxed{a+b=9}$$

$$\boxed{a=6}$$

$$\boxed{a=6, b=3}$$

$$\frac{x}{6} + \frac{y}{3} = 1$$

$$\Rightarrow \underline{\underline{x + 2y = 6}}$$

$$\boxed{a=3}$$

$$\boxed{a=3, b=6}$$

$$\frac{x}{3} + \frac{y}{6} = 1$$

$$\Rightarrow \underline{\underline{2x + y = 6}}$$

Q.14

Point $(0, 2)$ ✓

angle with positive x-axis = $\frac{2\pi}{3} = \theta$

slope = $m_1 = \tan \theta$

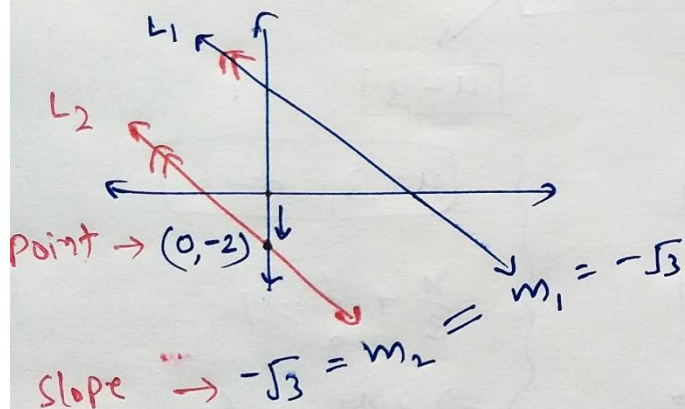
$$m_1 = \tan\left(\frac{2\pi}{3}\right) = -\sqrt{3}$$

By point-slope-form: →

$$(y - 2) = -\sqrt{3}(x - 0)$$

$$\Rightarrow y - 2 = -\sqrt{3}x$$

$$\Rightarrow y = -\sqrt{3}x + 2$$

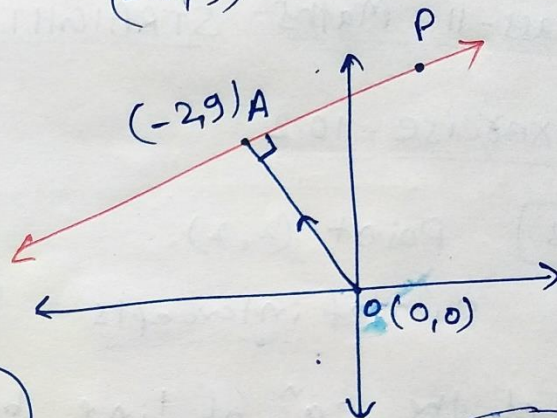


$$L_2: y - (-2) = (-\sqrt{3})(x - 0)$$

$$\Rightarrow y + 2 = -\sqrt{3}x$$

Q.15

$(-2, 9)$

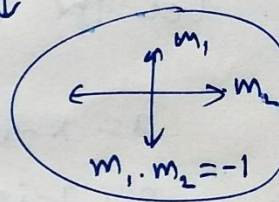


Line AP = ?

Point
 $A(-2, 9)$

Slope

$$m_{AP} = \frac{2}{9}$$



$\therefore OA \perp AP$

$$\Rightarrow m_{OA} \cdot m_{AP} = -1$$

$$\Rightarrow \left(\frac{9-0}{-2-0}\right) \cdot m_{AP} = -1$$

$$\Rightarrow \left(\frac{9}{-2}\right) \cdot m_{AP} = -1$$

$$\Rightarrow m_{AP} = \frac{2}{9}$$

By point-slope-form

$$\Rightarrow y - 9 = \frac{2}{9}(x - (-2))$$

$$\Rightarrow 9y - 81 = 2x + 4$$

$$\Rightarrow 9y = 2x + 85$$

Q.16

$$(C_1, L_1) \rightarrow C_1 = 20 \rightarrow L_1 = 124.942$$

$$\begin{array}{l} C \rightarrow x \\ L \rightarrow y \end{array}$$

$$(C_2, L_2) \rightarrow C_2 = 110 \rightarrow L_2 = 125.134$$

Express L in terms of C

Linear fn^m $\rightarrow$ Relation $(L = mC + d)$
 $\downarrow$
Straight Line

Two-Point form

$$(y - y_1) = \left(\frac{y_2 - y_1}{x_2 - x_1} \right) \cdot (x - x_1)$$

$$\begin{array}{l} y \rightarrow L \\ x \rightarrow C \end{array} \Rightarrow (L - L_1) = \frac{L_2 - L_1}{C_2 - C_1} (C - C_1)$$

$$\Rightarrow L - 124.942 = \frac{125.134 - 124.942}{110 - 20} \cdot (C - 20)$$

$$\Rightarrow \boxed{L - 124.942 = \frac{0.192}{90} (C - 20)} \quad \checkmark$$

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Class - II - Maths STRAIGHT-LINES

Exercise - 10.2

Q.17

$$x_1 = ₹ 14/L \quad y_1 = 980 L \quad \begin{array}{l} x \rightarrow \text{Rate} \\ y \rightarrow \text{Volume} \end{array}$$

$$x_2 = ₹ 16/L \quad y_2 = 1220 L$$

$$x_3 = ₹ 17/L \quad y_3 = ?$$

By two-point form:

$$(y - y_1) = \left(\frac{y_2 - y_1}{x_2 - x_1} \right) \cdot (x - x_1)$$

$$\Rightarrow y - 980 = \frac{1220 - 980}{16 - 14} (x - 14)$$

$$\Rightarrow y - 980 = \frac{240}{2} (x - 14)$$

$$\Rightarrow y - 980 = 120 (x - 14)$$

$$\boxed{y - 980 = 120 (x - 14)} \quad \checkmark$$

$$\begin{array}{c} (x_3, y_3) \\ \downarrow \\ 17 \end{array}$$

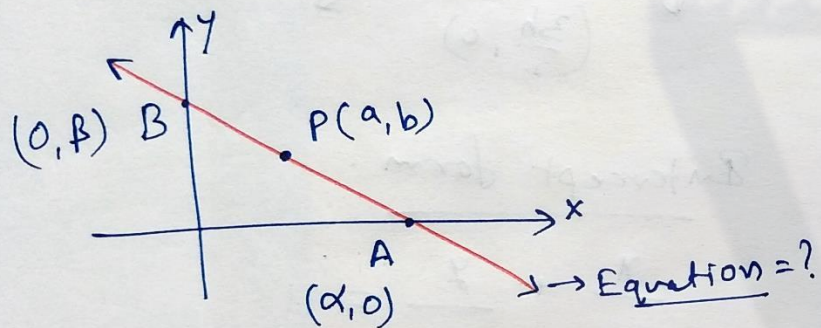
$$\Rightarrow y_3 - 980 = 120 (17 - 14)$$

$$\Rightarrow y_3 - 980 = 360$$

$$\Rightarrow y_3 = 1340 L$$

Q.18 $P(a,b)$ is mid point
of line segment b/w axes.

To Prove $\boxed{\text{Line} \equiv \frac{x}{a} + \frac{y}{b} = 2}$



$\therefore$ ~~AB~~ mid point of $AB = P$

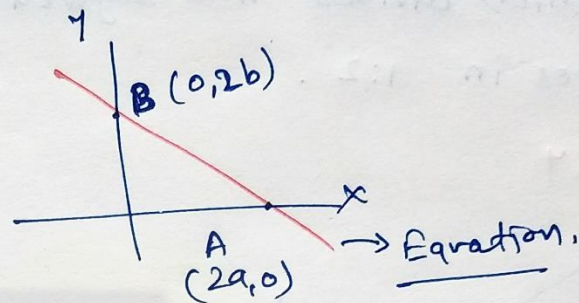
$$P(a,b) \equiv P\left(\frac{a+0}{2}, \frac{0+b}{2}\right)$$

(given)

(self)

$$a = \frac{a}{2} \quad b = \frac{b}{2}$$

$$\underline{a = 2a} \quad \underline{b = 2b}$$



Intercept form!

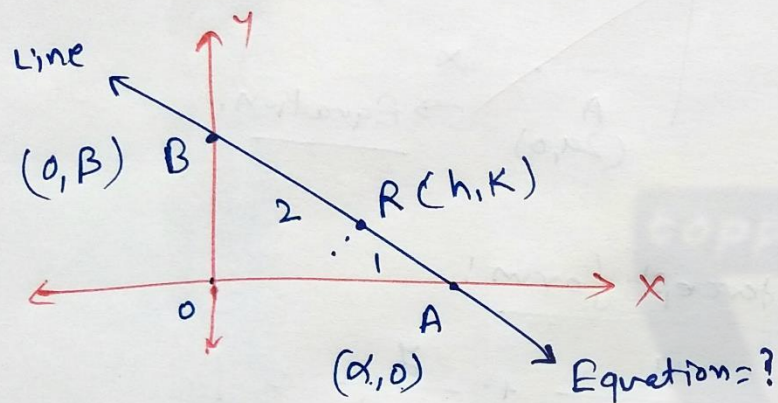
$$\frac{x}{\boxed{2a}} + \frac{y}{\boxed{2b}} = 1$$

x-intercept y-intercept

$$\Rightarrow \left(\frac{x}{2a} + \frac{y}{2b} = 1 \right) \times 2$$

$$\Rightarrow \boxed{\frac{x}{a} + \frac{y}{b} = 2} \quad \checkmark$$

Q.19 $R(h, k)$ divides line segment
b/w axes in 1:2.



By section formula:

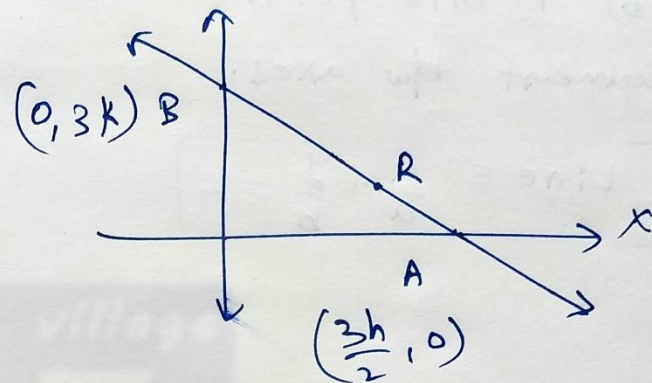
$$R\left(\frac{2\alpha + 0}{2+1}, \frac{0 + \beta}{2+1}\right)$$

$$\Rightarrow R\left(\frac{2\alpha}{3}, \frac{\beta}{3}\right) \equiv R(h, k) \quad \begin{matrix} \text{Self} \\ \text{Given} \end{matrix}$$

Comparison:

$$\frac{2\alpha}{3} = h \quad \left| \quad \frac{\beta}{3} = k \right.$$

$$\Rightarrow \boxed{\alpha = \frac{3h}{2}}, \quad \Rightarrow \boxed{\beta = 3k}$$



Intercept form.

$$\frac{x}{\left(\frac{3h}{2}\right)} + \frac{y}{3k} = 1$$

$$\Rightarrow \left(\frac{2x}{3h} + \frac{y}{3k} = 1\right) \cdot 3$$

$$\Rightarrow \boxed{\frac{2x}{h} + \frac{y}{k} = 3} \quad \checkmark$$

Q.20

Prove that: $\overset{A}{(3,0)}, \overset{B}{(-2,-2)}, \overset{C}{(8,2)}$
collinear

Concept: Equation of Line

Equation of Line AB

A(3,0) B(-2,-2)

2-point form:

$$y - y_1 = \frac{y_2 - y_1}{x_2 - x_1} (x - x_1)$$

$$\Rightarrow y - 0 = \frac{-2 - 0}{-2 - 3} (x - 3)$$

$$\Rightarrow y = \frac{+2}{+5} (x - 3)$$

$$\Rightarrow \boxed{5y = 2x - 6} \swarrow \nwarrow$$

AB

Now we have ~~to~~ to show
that C lies on AB.

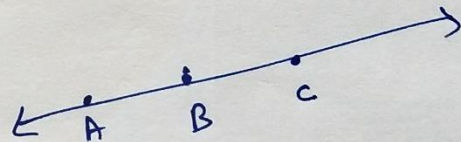
$$\begin{array}{ccc} \downarrow & & \downarrow \\ (8,2) & \rightarrow & 5y = 2x - 6 \end{array}$$

$$\Rightarrow 5 \times 2 = 2 \times 8 - 6$$

$$\Rightarrow 10 = 16 - 6$$

$$\Rightarrow 10 = 10$$

$\therefore$ C lies on the line AB.

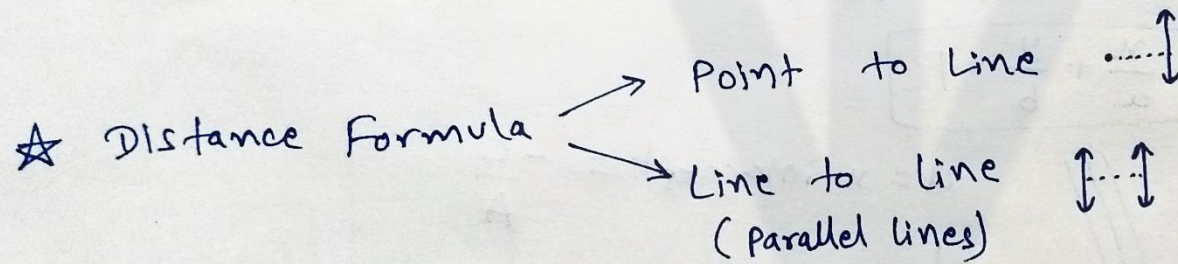
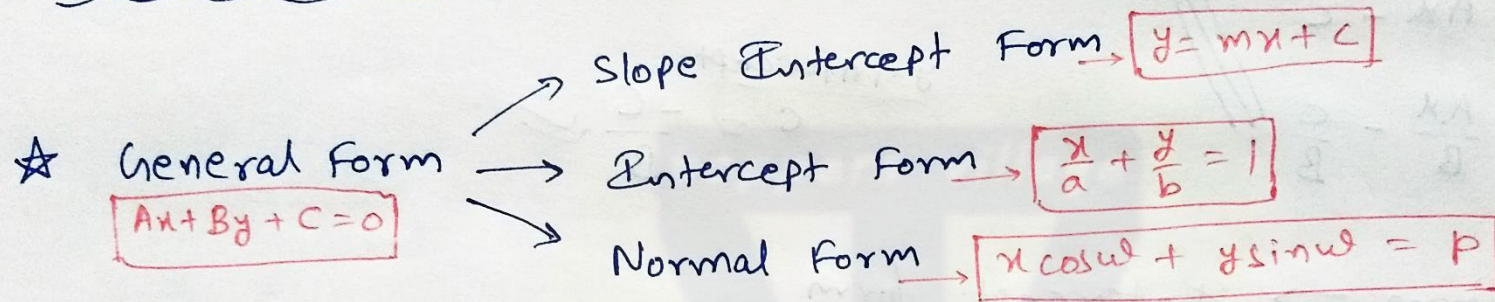


$\therefore A, B, C \rightarrow$ Collinear ✓

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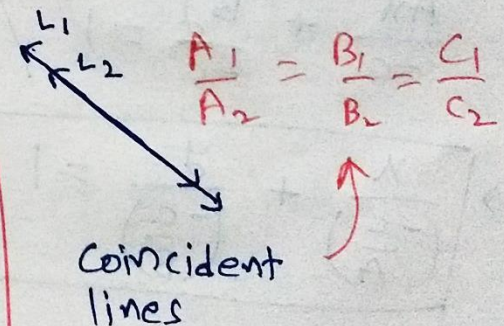
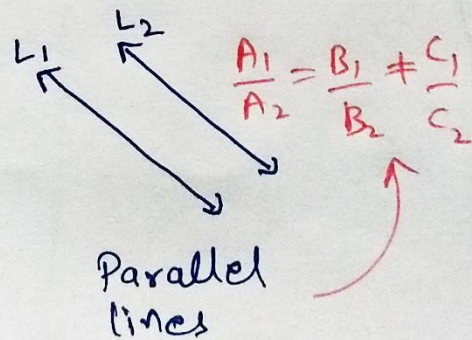
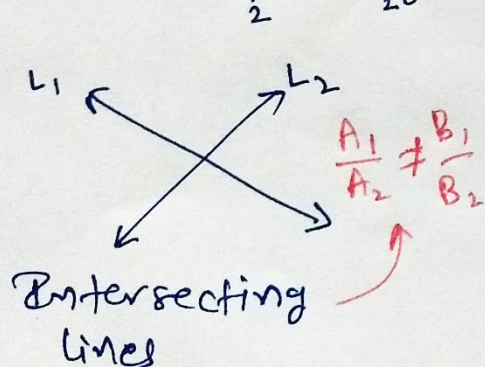
Class-II-Maths STRAIGHT LINES

Theory Before Exercise (10.3)



Note. $L_1: A_1x + B_1y + C_1 = 0$

$L_2: A_2x + B_2y + C_2 = 0$



① General Form $\rightarrow$ Slope intercept form

$$\boxed{Ax + By + C = 0}$$

$$\boxed{y = m \cdot x + c}$$

$$\Rightarrow By = -Ax - c$$

$$\Rightarrow y = -\frac{Ax}{B} - \frac{c}{B}$$

Slope
 $\therefore m = -\frac{A}{B}$ ✓✓

y-intercept
 $c = -\frac{C}{B}$ ✓✓

② General Form $\rightarrow$ Intercept form

$$\boxed{Ax + By + C = 0}$$

$$\boxed{\frac{x}{a} + \frac{y}{b} = 1}$$

$$\Rightarrow Ax + By = -C \times 1$$

$$\Rightarrow \frac{Ax + By}{-C} = 1$$

$$\Rightarrow \frac{Ax}{-C} + \frac{By}{-C} = 1$$

$$\Rightarrow \boxed{\frac{x}{\left(-\frac{C}{A}\right)} + \frac{y}{\left(-\frac{C}{B}\right)} = 1}$$

$$a = x\text{-intercept} = -\frac{C}{A}$$

$$b = y\text{-intercept} = -\frac{C}{B}$$

③ ~~Normal~~ General Form $\rightarrow$ Normal Form

$$Ax + By + C = 0$$

$$x \cos \omega + y \sin \omega = p$$

$$\Rightarrow x \cos \omega + y \sin \omega - p = 0$$

Same lines (coincident lines)

$$\cos \omega = \pm \frac{A}{\sqrt{A^2 + B^2}}$$

$$\sin \omega = \pm \frac{B}{\sqrt{A^2 + B^2}}$$

$$p = \pm \frac{C}{\sqrt{A^2 + B^2}}$$

$$\Rightarrow \frac{A}{\cos \omega} = \frac{B}{\sin \omega} = \frac{C}{-p}$$

$$\frac{A}{\cos \omega} = \frac{C}{-p}$$

$$\frac{B}{\sin \omega} = \frac{C}{-p}$$

$$\Rightarrow \left[\frac{-pA}{C} = \cos \omega \right]$$

$$\Rightarrow \left[\frac{-pB}{C} = \sin \omega \right]$$

$$\because \cos^2 \omega + \sin^2 \omega = 1$$

$$\Rightarrow \left(\frac{-pA}{C} \right)^2 + \left(\frac{-pB}{C} \right)^2 = 1$$

$$\Rightarrow \frac{(p^2)A^2}{C^2} + \frac{(p^2)B^2}{C^2} = 1$$

$$\Rightarrow p^2 \left(\frac{A^2 + B^2}{C^2} \right) = 1$$

$$\Rightarrow p^2 = \frac{C^2}{A^2 + B^2}$$

$$\Rightarrow \left[p = \pm \frac{C}{\sqrt{A^2 + B^2}} \right]$$

$$\cos \omega = \frac{-pA}{C} = - \left(\pm \frac{C}{\sqrt{A^2 + B^2}} \right) \cdot A = \pm \frac{A}{\sqrt{A^2 + B^2}}$$

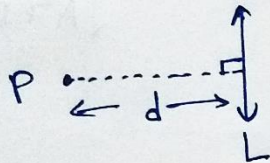
$$\sin \omega = \frac{-pB}{C} = - \left(\pm \frac{C}{\sqrt{A^2 + B^2}} \right) \cdot B = \pm \frac{B}{\sqrt{A^2 + B^2}}$$

Distance formulae

① Point to line

P (x_1, y_1)

$$Ax + By + C = 0$$

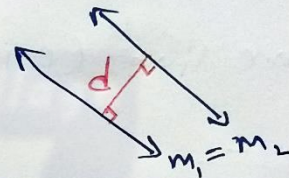


$$d = \left| \frac{Ax_1 + By_1 + C}{\sqrt{A^2 + B^2}} \right| \quad \star$$

② Line to line

$$Ax + By + C_1 = 0$$

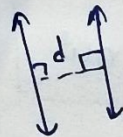
$$Ax + By + C_2 = 0$$



$$m_1 = m_2$$

$$d = \left| \frac{C_1 - C_2}{\sqrt{A^2 + B^2}} \right| \quad \star$$

Note.



$$y = mx + c_1$$

$$y = mx + c_2$$

$$d = \left| \frac{c_1 - c_2}{\sqrt{m^2 + 1}} \right|$$

e.g. ① Point
(2,3)

line
 $3x - 4y = 1$

$$\boxed{\text{Distance} = ?} \Rightarrow \underline{3x - 4y - 1 = 0}$$

$$d = \left| \frac{3x_2 - 4(3) - 1}{\sqrt{3^2 + (-4)^2}} \right|$$

$$d = \left| \frac{6 - 12 - 1}{\sqrt{9 + 16}} \right|$$

$$d = \left| \frac{-7}{5} \right|$$

$$\boxed{d = \frac{7}{5}} \quad \checkmark$$

e.g. ② line₁

$$\boxed{3x - 4y = 5}$$

line₂

$$\boxed{6x - 8y = 4}$$

$$\boxed{\text{Distance} = ?}$$

$$\boxed{L_1: 3x - 4y - 5 = 0}$$

$$L_2: \underline{6x - 8y - 4 = 0}$$

$\swarrow$
 d
 $\searrow$

$$\boxed{L_2: 3x - 4y - 2 = 0}$$

$$\text{Distance} = d = \left| \frac{(-5) - (-2)}{\sqrt{(3)^2 + (-4)^2}} \right|$$

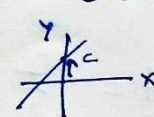
$$d = \left| \frac{-5 + 2}{\sqrt{25}} \right|$$

$$d = \left| \frac{-3}{5} \right|$$

$$\boxed{d = \frac{3}{5}} \quad \checkmark$$

Exercise - 10.3

Q.1 reduce into Slope-Intercept form



$$y = mx + c$$

(i) $x + 7y = 0$

$$\Rightarrow 7y = -x$$

$$\Rightarrow y = -\frac{x}{7}$$

$$\Rightarrow y = -\frac{x}{7} + 0$$

$$m = -\frac{1}{7}, c = 0$$

Slope-Intercept form

(ii) $6x + 3y - 5 = 0$

$$\Rightarrow 3y = -6x + 5$$

$$\Rightarrow y = -\frac{6x}{3} + \frac{5}{3}$$

$$\Rightarrow y = -2x + \frac{5}{3}$$

Slope = $m = -2$

y-intercept = $c = \frac{5}{3}$

(iii) $y = 0$

$$y = mx + c$$

$$\Rightarrow y = 0 + 0$$

$$\Rightarrow y = 0 \cdot x + 0$$

$$m = 0 \checkmark$$

$$c = 0 \checkmark$$

Q.2 reduce into intercept form

$$\frac{x}{a} + \frac{y}{b} = 1$$

x-intercept

y-intercept

(i) $3x + 2y - 12 = 0$

$$\Rightarrow 3x + 2y = 12 \times 1$$

$$\Rightarrow \frac{3x}{12} + \frac{2y}{12} = 1$$

$$\Rightarrow \frac{3x}{12} + \frac{2y}{12} = 1$$

$$\Rightarrow \frac{x}{4} + \frac{y}{6} = 1 \checkmark$$

x-intercept = 4 $\checkmark$

y-intercept = 6 $\checkmark$

$$(ii) \quad 4x - 3y = 6$$

$$\frac{x}{a} + \frac{y}{b} = 1$$

$$\Rightarrow 4x - 3y = 6 \times 1$$

$$\Rightarrow \frac{4x}{6} - \frac{3y}{6} = 1$$

$$\Rightarrow \frac{2x}{3} - \frac{y}{2} = 1$$

$$\Rightarrow \boxed{\frac{x}{(\frac{3}{2})} + \frac{y}{(-2)} = 1} \quad \checkmark$$

$$x\text{-intercept} = \frac{3}{2} \quad \checkmark$$

$$y\text{-intercept} = -2 \quad \checkmark$$

$$(iii) \quad 3y + 2 = 0$$

$$\Rightarrow 3y = -2$$

$$\Rightarrow 3y = -2 \times 1$$

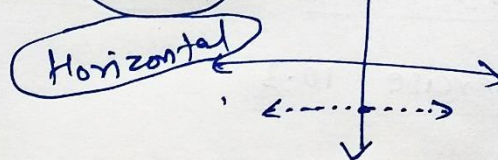
$$\Rightarrow \frac{3y}{-2} = 1$$

$$\Rightarrow \frac{3y}{-2} = 1$$

$$\Rightarrow \frac{y}{(-\frac{2}{3})} = 1$$

$$\Rightarrow \boxed{\frac{x}{\infty} + \frac{y}{(-\frac{2}{3})} = 1}$$

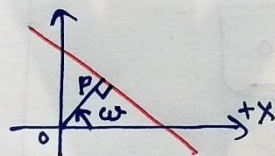
$$y = -\frac{2}{3}$$



$$y\text{-intercept} = -\frac{2}{3}$$

$$x\text{-intercept} = \text{Not none.}$$

③ reduce into Normal form



$$x \cos(\omega) + y \sin(\omega) = p$$

angle Distance → ④

$$(i) \quad x - \sqrt{3}y + 8 = 0$$

$$\Rightarrow x - \sqrt{3}y = -8$$

$$A = 1, B = -\sqrt{3}$$

$$\sqrt{A^2 + B^2} = \sqrt{1 + (-\sqrt{3})^2}$$

$$= \sqrt{1 + 3} = \sqrt{4} = 2$$

Divide

$$Ax + By + C = 0$$

$$\sqrt{A^2 + B^2} \rightarrow \text{Divide}$$

$$\Rightarrow \frac{x - \sqrt{3}y}{2} = \frac{-8}{2}$$

$$\Rightarrow \frac{x}{2} - \frac{\sqrt{3}}{2}y = -4 = \textcircled{+}$$

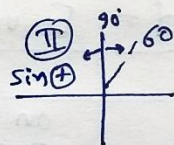
$$\Rightarrow \boxed{-\frac{x}{2} + \frac{\sqrt{3}}{2}y = 4}$$

$$\boxed{x \cos \omega + y \sin \omega = p}$$

$p = 4 = \perp$ distance from origin

$$\cos 120^\circ = \cos \omega = -\frac{1}{2}$$

$$\sin \omega = \frac{\sqrt{3}}{2} = \sin 120^\circ$$



$$\boxed{x \cos 120^\circ + y \sin 120^\circ = 4}$$

$$p = 4$$

$$\omega = 120^\circ = \frac{2\pi}{3}$$

$$\textcircled{\text{II}} \quad y - 2 = 0$$

$$\Rightarrow y = 2$$

$$\Rightarrow 0 \cdot x + 1 \cdot y = 2$$

$$\begin{matrix} \downarrow & \downarrow \\ A & B \end{matrix} \quad \sqrt{A^2 + B^2} = \sqrt{0+1} = 1$$

$$\Rightarrow \boxed{0 \cdot x + 1 \cdot y = 2}$$

$$\boxed{x \cos \omega + y \sin \omega = p}$$

$$p = 2$$

$$\left. \begin{matrix} \cos \omega = 0 \\ \sin \omega = 1 \end{matrix} \right\} \omega = 90^\circ$$

$$\boxed{x \cos 90^\circ + y \sin 90^\circ = 2}$$

$$2 = \frac{\sqrt{2} \cdot \sqrt{2}}{\sqrt{2}} = \frac{2}{\sqrt{2}} = \sqrt{2}$$

$$\textcircled{\text{iii}} \quad x - y = 4$$

$$\sqrt{1^2 + (-1)^2} = \sqrt{2}$$

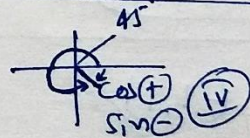
$$\Rightarrow \frac{x}{\frac{1}{\sqrt{2}}} - \frac{y}{\frac{1}{\sqrt{2}}} = 2\sqrt{2}$$

$$x \cos \omega + y \sin \omega = p$$

$$\cos \omega = \frac{1}{\sqrt{2}}$$

$$\sin \omega = -\frac{1}{\sqrt{2}}$$

$$p = 2\sqrt{2}$$



$$\begin{matrix} 270 \\ + 45 \\ \hline 315 \end{matrix}$$

$$\omega = 315^\circ$$

$$\boxed{x \cos 315^\circ + y \sin 315^\circ = 2\sqrt{2}}$$

Toppers Village

Class-11-Maths STRAIGHT LINES

Exercise 10.3

Revision

✓ ① Point to line $\rightarrow$ Distance $\rightarrow d = \left| \frac{Ax_1 + By_1 + C}{\sqrt{A^2 + B^2}} \right|$

$\downarrow$
 (x_1, y_1)

$\downarrow$
 $Ax + By + C = 0$

✓ ② Line to line $\rightarrow$ Distance $\rightarrow d = \left| \frac{C_1 - C_2}{\sqrt{A^2 + B^2}} \right|$

$\swarrow$ $\searrow$

$Ax + By + C_1 = 0$ $Ax + By + C_2 = 0$

$m_1 = -\frac{A}{B} = m_2$

Q.4

$(-1, 1)$ $12(x+6) = 5(y-2)$

$\Rightarrow 12x + 72 = 5y - 10$

$\Rightarrow \boxed{12x - 5y + 82 = 0}$

 $(-1, 1)$

$$12x - 5y + 82 = 0$$

$$d = \left| \frac{12(-1) - 5(1) + 82}{\sqrt{(12)^2 + (-5)^2}} \right|$$

$$d = \left| \frac{-12 - 5 + 82}{\sqrt{144 + 25}} \right|$$

$$d = \left| \frac{65}{\sqrt{169}} \right| = \frac{65}{13}^5$$

$d = 5 \text{ units}$

Q.5

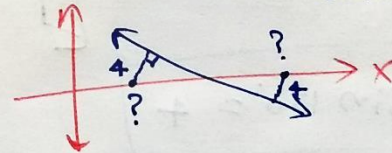
on X-axis

Point

4

line

$\frac{x}{3} + \frac{y}{4} = 1$



Let Point $\rightarrow \underline{(x, 0)}$ $\leftarrow$ on the ~~xxx~~ x-axis.

Point $(\alpha, 0)$

line

$$\frac{x}{3} + \frac{y}{4} - 1 = 0$$

$d=4$

$$d = 4 = \left| \frac{\frac{\alpha}{3} + \frac{0}{4} - 1}{\sqrt{\frac{1}{3^2} + \frac{1}{4^2}}} \right|$$

$$\Rightarrow 4 = \left| \frac{\frac{\alpha}{3} - 1}{\sqrt{\frac{1}{9} + \frac{1}{16}}} \right|$$

$$\Rightarrow 4 = \left| \frac{\frac{\alpha-3}{3}}{\sqrt{\frac{16+9}{9 \times 16}}} \right|$$

$$\Rightarrow 4 = \left| \frac{\frac{\alpha-3}{3}}{\frac{5}{8 \times 4}} \right|$$

$$\Rightarrow 4 = \left| \frac{4\alpha-12}{5} \right| \Rightarrow \cancel{4} = \cancel{4} \cdot \left| \frac{\alpha-3}{5} \right|$$

$$\Rightarrow \boxed{5 = |\alpha-3|}$$

$$\alpha-3 = 5 \quad / \text{or} / \quad \alpha-3 = -5$$

$$\boxed{\alpha = 5} \checkmark$$

$$\alpha = 3-5$$

$$\boxed{\alpha = -2} \checkmark$$

Point $\rightarrow (\alpha, 0)$

Points $\rightarrow (5, 0), (-2, 0) \checkmark$

Q.6 Distance between Parallel lines

(i) $15x + 8y - 34 = 0$, $15x + 8y + 31 = 0$

$$d = \left| \frac{(-34) - (31)}{\sqrt{15^2 + 8^2}} \right| = \left| \frac{-65}{\sqrt{225+64}} \right| = \frac{65}{\sqrt{289}}$$

$$\boxed{d = \frac{65}{17}} \checkmark$$

Q.6 (ii) $l(x+y) + p = 0 \Rightarrow lx + ly + p = 0$

$$l(x+y) - r = 0 \Rightarrow lx + ly - r = 0$$

$$d = \left| \frac{(p) - (-r)}{\sqrt{l^2 + l^2}} \right|$$

$$d = \left| \frac{p+r}{\sqrt{2}l} \right|$$

$$d = \frac{|p+r|}{\sqrt{2}l} = \frac{1}{\sqrt{2}} \left| \frac{p+r}{l} \right| \text{ units}$$

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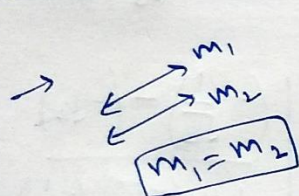
Class-11-Maths Straight Lines

Exercise (10.3)

Revision

→ Slope intercept form

$$y = mx + c$$



→ Angle between two lines θ

$$\tan \theta = \left| \frac{m_2 - m_1}{1 + m_1 m_2} \right|$$

acute

Q.7

$$3x - 4y + 2 = 0$$

$(2, 3)$

$$3x - 4y + 2 = 0$$

$$\Rightarrow -4y = -3x - 2$$

$$\Rightarrow y = \frac{-3x}{-4} - \frac{2}{-4}$$

$$\Rightarrow y = \frac{3}{4}x + \frac{1}{2}$$

$$m_1 = \frac{3}{4}$$

$$m_1 = m_2$$

$$\left[\frac{3}{4} = m_2 \right]$$

Let eqⁿ.

$$y = m_2 x + c$$

$$\Rightarrow y = \frac{3}{4}x + c$$

$(-2, 3)$ lies on it

$$\Rightarrow 3 = \frac{3}{4}(-2) + c$$

$$\Rightarrow 3 + \frac{3}{2} = \frac{9}{2} = c$$

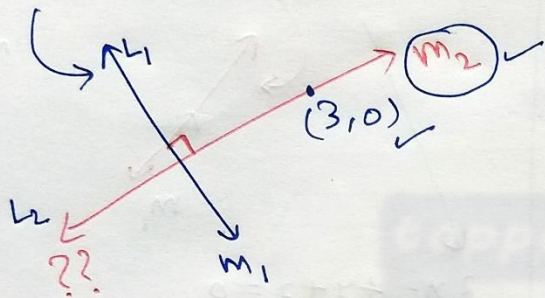
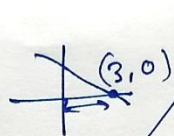
Line

$$y = \frac{3}{4}x + \frac{9}{2}$$

Q.8

$$x - 7y + 5 = 0$$

x-intercept = 3



$$x - 7y + 5 = 0$$

$$\Rightarrow x + 5 = 7y$$

$$\Rightarrow \frac{x}{7} + \frac{5}{7} = y$$

$$\Rightarrow y = \frac{x}{7} + \frac{5}{7}$$

$$\text{Slope } m_1 = \frac{1}{7}$$

$$\therefore L_1 \perp L_2$$

$$\Rightarrow m_1 \cdot m_2 = -1$$

$$\Rightarrow \frac{1}{7} \cdot m_2 = -1$$

$$\Rightarrow m_2 = -7$$

Let eqⁿ. of L_2

$$\Rightarrow y = m_2 x + c$$

$$\Rightarrow y = -7x + c$$

(3, 0) ↑

$$\Rightarrow 0 = -7 \times 3 + c$$

$$\Rightarrow 0 = -21 + c$$

$$\Rightarrow 21 = c$$

$$L_2: y = -7x + 21$$

Q.9

$$y = mx + c$$

$$\sqrt{3}x + y = 1$$

$$x + \sqrt{3}y = 1$$

$$\Rightarrow y = -\sqrt{3}x + 1$$

$$m_1 = -\sqrt{3}$$

$$\Rightarrow \sqrt{3}y = -x + 1$$

$$\Rightarrow y = -\frac{1}{\sqrt{3}}x + \frac{1}{\sqrt{3}}$$

$$m_2 = -\frac{1}{\sqrt{3}}$$

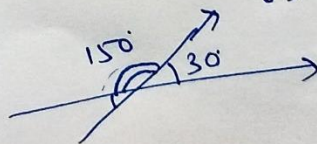
angle b/w them = θ

$$\tan \theta = \left| \frac{m_2 - m_1}{1 + m_1 m_2} \right| = \left| \frac{-\frac{1}{\sqrt{3}} - (-\sqrt{3})}{1 + (-\sqrt{3})(-\frac{1}{\sqrt{3}})} \right|$$

$$\Rightarrow \tan \theta = \left| \frac{-\frac{1}{\sqrt{3}} + \sqrt{3}}{1 + 1} \right|$$

$$\Rightarrow \tan \theta = \left| \frac{\frac{-1 + 3}{\sqrt{3}}}{\left(\frac{2}{1}\right)} \right| \Rightarrow \tan \theta = \left| \frac{2}{2\sqrt{3}} \right|$$

$$\Rightarrow \tan \theta = \frac{1}{\sqrt{3}} = \tan 30^\circ$$



$$\theta = 30^\circ$$

Exercise (10.3)

Q.10 A(h, 3)

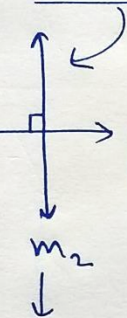
B(4, 1)

$m_1 = \frac{y_2 - y_1}{x_2 - x_1}$

$m_1 = \frac{3-1}{h-4}$

$m_1 = \frac{2}{h-4}$

$7x - 9y - 19 = 0$



$m_1 m_2 = -1$

$7x - 9y - 19 = 0$

$\Rightarrow -9y = -7x + 19$

$\Rightarrow y = \frac{+7x}{+9} + \frac{19}{-9}$

$\Rightarrow y = \left(\frac{7}{9}\right) \cdot x - \frac{19}{9}$

$m_2 = \frac{7}{9}$

$m_1 m_2 = -1$ (for perpendicular lines)

$\Rightarrow \left(\frac{2}{h-4}\right) \cdot \left(\frac{7}{9}\right) = -1$

$\Rightarrow \frac{14}{9h-36} = -1$

$\Rightarrow 14 = -9h + 36$

$\Rightarrow 9h = 36 - 14$

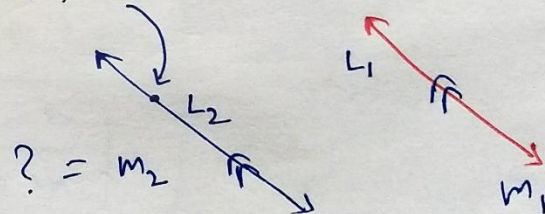
$\Rightarrow 9h = 22$

$\Rightarrow h = \frac{22}{9}$

Q.11

(x_1, y_1)

$Ax + By + C = 0$



$? = m_2$

??

$m_1 = m_2$

$$Ax + By + C = 0$$

$$\Rightarrow By = -Ax - C$$

$$\Rightarrow y = \left(-\frac{Ax}{B} \right) - \frac{C}{B}$$

$$\text{Slope} = m_1 = -\frac{A}{B}$$

$$\therefore L_1 \parallel L_2$$

$$\Rightarrow m_1 = m_2$$

$$\Rightarrow \left[-\frac{A}{B} = m_2 \right]$$

By point slope form

$$\begin{array}{c} \downarrow \qquad \qquad \downarrow \\ (x_1, y_1) \quad -\frac{A}{B} = m_2 \end{array}$$

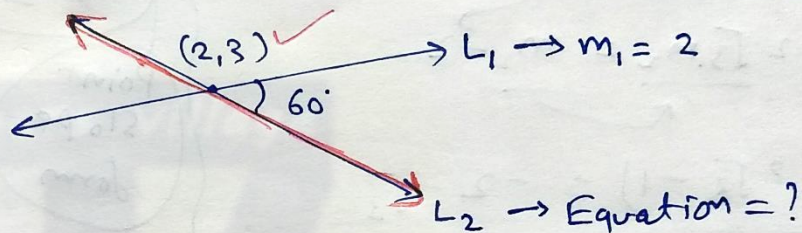
$$\Rightarrow (y - y_1) = m_2(x - x_1)$$

$$\Rightarrow (y - y_1) = -\frac{A}{B}(x - x_1)$$

$$\Rightarrow B(y - y_1) = -A(x - x_1)$$

$$\Rightarrow \boxed{A(x - x_1) + B(y - y_1) = 0}$$

Q.12



$$m_2 = ?$$

Angle b/w two lines $= 60^\circ = \theta \leftarrow \text{Acute}$

$$\Rightarrow \tan \theta = \left| \frac{m_2 - m_1}{1 + m_1 m_2} \right|$$

$$\Rightarrow \tan 60^\circ = \left| \frac{m_2 - 2}{1 + 2m_2} \right|$$

$$\Rightarrow \boxed{\sqrt{3} = \left| \frac{m_2 - 2}{1 + 2m_2} \right|}$$

$$\begin{array}{c} + \sqrt{3} \\ - \sqrt{3} \end{array}$$

Case-I

$$\sqrt{3} = \frac{m_2 - 2}{1 + 2m_2}$$

$$\Rightarrow \sqrt{3} + 2\sqrt{3}m_2 = m_2 - 2$$

$$\Rightarrow m_2(2\sqrt{3} - 1) = -2 - \sqrt{3}$$

$$\Rightarrow \boxed{m_2 = \frac{-(2 + \sqrt{3})}{2\sqrt{3} - 1}}$$

Case-II

$$-\sqrt{3} = \frac{m_2 - 2}{1 + 2m_2}$$

$$\Rightarrow -\sqrt{3} - 2\sqrt{3}m_2 = m_2 - 2$$

$$\Rightarrow 2 - \sqrt{3} = m_2(2\sqrt{3} + 1)$$

$$\boxed{m_2 = \frac{2 - \sqrt{3}}{2\sqrt{3} + 1}}$$

$$y - y_1 = m(x - x_1)$$

(2, 3) ✓
(L₂) ✓
m₂ ✓

Case-I

Point
Slope
form

$$L_2: (y - 3) = \frac{-(2 + \sqrt{3})}{(2\sqrt{3} - 1)} \cdot (x - 2)$$

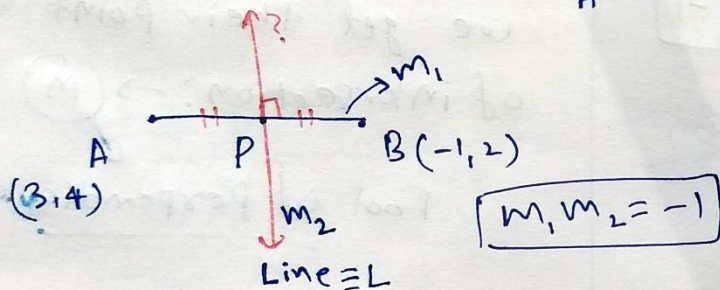
Case-II

$$L_2: (y - 3) = \left(\frac{2 - \sqrt{3}}{2\sqrt{3} + 1} \right) \cdot (x - 2)$$

Class-11-Maths Straight Lines

Exercise 10.3

Q.13 right Bisector of
line segment joining $(3,4)$, $(-1,2)$
A B



$\therefore$ P is mid point of AB

$$\Rightarrow P\left(\frac{3+(-1)}{2}, \frac{4+2}{2}\right) \equiv P(1,3)$$

$\therefore L \perp AB$

$$\therefore m_1 \cdot m_2 = -1$$

$$\Rightarrow \left(\frac{4-2}{3+1}\right) \cdot m_2 = -1$$

$$\Rightarrow \frac{2}{4} \cdot m_2 = -1$$

$$\Rightarrow \boxed{m_2 = -2}$$

Line : L $\rightarrow$ point $P(1,3)$
Slope = $m_2 = -2$

point slope form

$$y - y_1 = m(x - x_1)$$

$$\Rightarrow y - 3 = -2(x - 1)$$

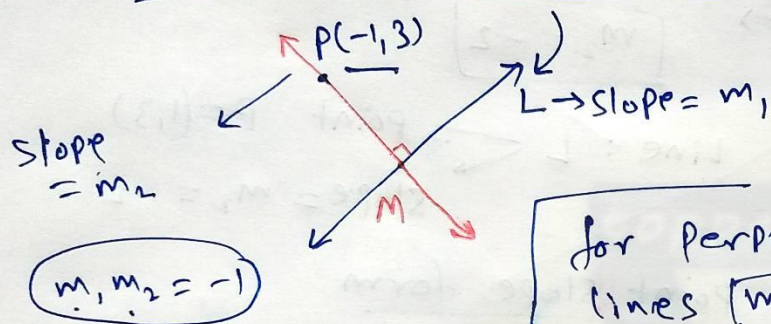
$$\Rightarrow y - 3 = -2x + 2$$

$$\Rightarrow \boxed{y + 2x = 5} \checkmark$$

Q.14

Q.14 foot of perpendicular

from $(-1, 3)$ to $3x - 4y - 16 = 0$



$$3x - 4y - 16 = 0$$

$$\Rightarrow -4y = -3x + 16$$

$$\Rightarrow y = -\frac{3x}{-4} + \frac{16}{-4}$$

$$\Rightarrow y = \frac{3x}{4} - 4$$
$$m_1 = \frac{3}{4}$$

for perpendicular
lines $m_1, m_2 = -1$

$$\Rightarrow \frac{3}{4} \cdot (m_2) = -1$$

$$\Rightarrow m_2 = -\frac{4}{3}$$

Eqⁿ. of PM

$$P(-1, 3), m_2 = -\frac{4}{3}$$

point slope form $\perp$

$$y - 3 = -\frac{4}{3}(x + 1)$$

$$\Rightarrow 3y - 9 = -4x - 4$$

$$\Rightarrow 3y + 4x = 9 - 4$$

$$\Rightarrow 4x + 3y = 5 \quad \text{--- (1)}$$

$$3x - 4y - 16 = 0 \quad \text{--- (2)}$$

By solving eqⁿ (1) & (2)

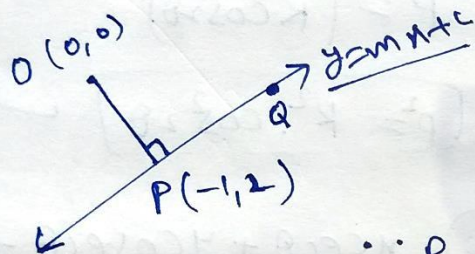
we get their point
of intersection: $\rightarrow (m)$

Foot of perpendicular

$$M\left(\frac{68}{25}, -\frac{49}{25}\right)$$

Q.15

Perpendicular from origin $(0,0)$
to line $y = mx + c \rightarrow (-1, 2)$



$\therefore P$ lies on PQ

$\therefore OP \perp PQ$

$$\Rightarrow m_{OP} \cdot m_{PQ} = -1$$

$$\Rightarrow \left(\frac{2-0}{-1-0} \right) \cdot m = -1$$

$$\Rightarrow \left(\frac{2}{-1} \right) \cdot m = -1$$

$$\Rightarrow m = \frac{1}{2}$$

$\Rightarrow (-1, 2)$ lies on $y = mx + c$

$$\Rightarrow 2 = -m + c$$

$$\Rightarrow 2 = -\frac{1}{2} + c$$

$$\Rightarrow 2 + \frac{1}{2} = c$$

$$\Rightarrow c = \frac{5}{2}$$

Toppers Village

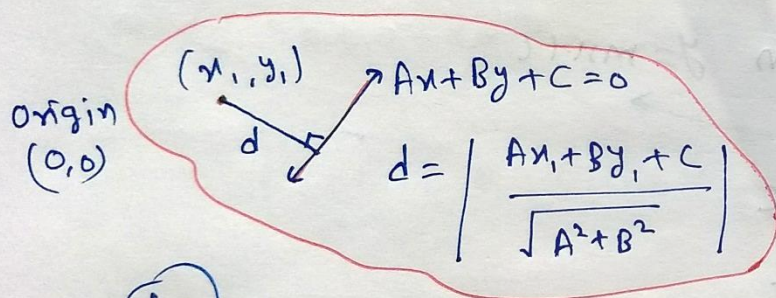
Class - 11 - Maths Straight Lines

Exercise - 10.3

Q.16

$$p \leftarrow x \cos \theta - y \sin \theta = K \cos 2\theta \quad (L_1)$$

$$q \leftarrow x \sec \theta + y \operatorname{cosec} \theta = K \quad (L_2)$$



(L1)

$$x \cos \theta - y \sin \theta - K \cos 2\theta = 0$$

(0,0)

$$p = \left| \frac{0 - 0 - K \cos 2\theta}{\sqrt{(\cos \theta)^2 + (-\sin \theta)^2}} \right|$$

$$\Rightarrow p = \left| \frac{K \cos 2\theta}{\sqrt{1}} \right|$$

$$\Rightarrow p = |K \cos 2\theta|$$

$$\Rightarrow p^2 = K^2 \cos^2 2\theta \quad \checkmark$$

$$(L_2) \quad x \sec \theta + y \operatorname{cosec} \theta - K = 0$$

(0,0)

$$q = \left| \frac{0 + 0 - K}{\sqrt{\sec^2 \theta + \operatorname{cosec}^2 \theta}} \right|$$

$$\Rightarrow q = \left| \frac{K}{\sqrt{\frac{1}{\cos^2 \theta} + \frac{1}{\sin^2 \theta}}} \right| = \left| \frac{K}{\sqrt{\frac{\sin^2 \theta + \cos^2 \theta}{\cos^2 \theta \cdot \sin^2 \theta}}} \right|$$

$$\Rightarrow q = \left| \frac{K}{\frac{1}{\cos \theta \cdot \sin \theta}} \right|$$

$$\Rightarrow q = |K \cdot \sin \theta \cdot \cos \theta|$$

$$\Rightarrow q^2 = K^2 (\sin \theta \cdot \cos \theta)^2$$

To Prove: $p^2 + 4q^2 = k^2$

$$\text{LHS} = p^2 + 4q^2$$

$$4 = 2^2$$

$$= k^2 \cos^2 2\theta + 4 \cdot k^2 (\sin \theta \cdot \cos \theta)^2$$

$$= k^2 \left\{ \cos^2 2\theta + (2 \sin \theta \cdot \cos \theta)^2 \right\}$$

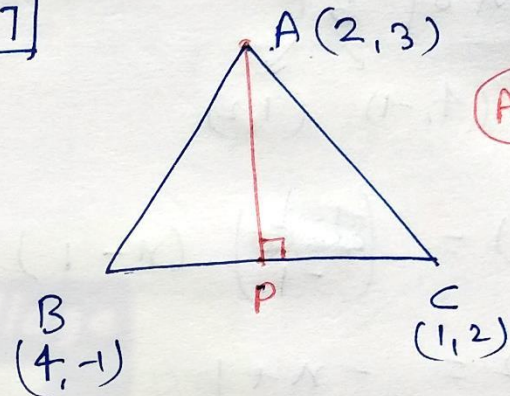
$$\therefore 2 \sin \theta \cdot \cos \theta = \sin 2\theta$$

$$= k^2 \{ \cos^2 2\theta + \sin^2 2\theta \}$$

$$= k^2 \cdot 1$$

$$= k^2 = \text{RHS.}$$

Q.17



$AP \perp BC$

$$m_{BC} = \frac{-1-2}{4-1} = \frac{-3}{3} = -1$$

$$m_{AP} \cdot m_{BC} = -1$$

$$\Rightarrow m_{AP} \cdot (-1) = (-1)$$

$$\Rightarrow m_{AP} = 1$$

Eqⁿ. of AP. $\rightarrow$ Point A (2, 3)
 $\rightarrow$ Slope = 1

Point Slope form:

$$(y-3) = (1) \cdot (x-2)$$

$$\Rightarrow y-3 = x-2$$

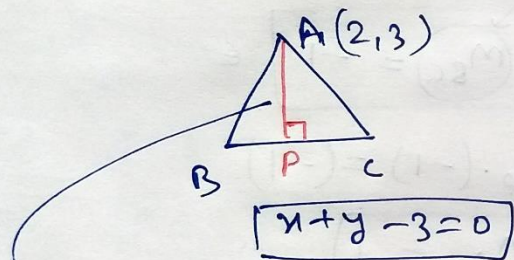
$$\Rightarrow y = x+1 \quad \text{--- AP}$$

Equation of BC
 $(4, -1) \quad (1, 2)$

$$(y - 2) = \left(\frac{2 - (-1)}{1 - 4} \right) \cdot (x - 1)$$

$$\Rightarrow y - 2 = -x + 1$$

$$\Rightarrow \boxed{x + y - 3 = 0} \text{ --- (BC)}$$



$$d = AP = \left| \frac{2 + 3 - 3}{\sqrt{1^2 + 1^2}} \right|$$

$$d = AP = \left| \frac{2}{\sqrt{2}} \right| = \sqrt{2} \text{ units}$$

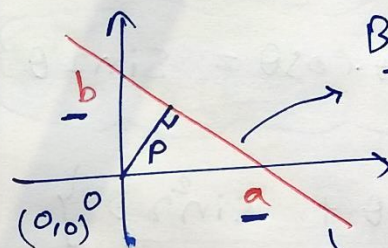
$$\boxed{2 = \sqrt{2} \times \sqrt{2}}$$

Q.18

intercepts $\rightarrow$ $\begin{matrix} a & b \\ \downarrow & \downarrow \\ (x) & (y) \end{matrix}$

$P \rightarrow$ length of
 Perpendicular
 from origin
 $(0, 0)$

$\rightarrow$ Perpendicular Distance.



By Intercept form

$$\frac{x}{a} + \frac{y}{b} = 1$$

$$\Rightarrow \boxed{\frac{x}{a} + \frac{y}{b} - 1 = 0}$$

Distance formula,

$$P = \left| \frac{0 + 0 - 1}{\sqrt{\frac{1}{a^2} + \frac{1}{b^2}}} \right| \Rightarrow P = \frac{1}{\sqrt{\frac{1}{a^2} + \frac{1}{b^2}}}$$

$$\Rightarrow \sqrt{\frac{1}{a^2} + \frac{1}{b^2}} = \frac{1}{P} \Rightarrow \boxed{\frac{1}{a^2} + \frac{1}{b^2} = \frac{1}{P^2}}$$

Toppers Village

Miscellaneous Exercise - Chapter (10)

Straight lines

Q.1

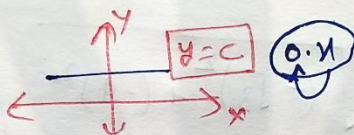
$$(k-3)x - (4-k^2)y + \underline{k^2 - 7k + 6} = 0$$

(a) parallel to x-axis

$$\text{Coefficient of } x = 0$$

$$\Rightarrow k - 3 = 0$$

$$\Rightarrow \boxed{k = 3} \checkmark$$



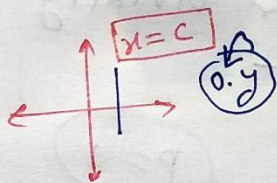
(b) parallel to y-axis

$$\text{Coeff. of } y = 0$$

$$\Rightarrow -(4 - k^2) = 0$$

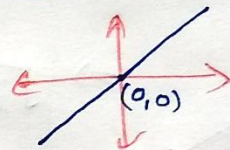
$$\Rightarrow 4 = k^2$$

$$\Rightarrow \boxed{k = \pm 2} \checkmark$$



(c) passing through the origin $(0,0)$

$$\boxed{Ax + By = 0}$$



$(0,0)$ lies on the line

$$\Rightarrow (k-3) \cdot 0 - (4-k^2) \cdot 0 + k^2 - 7k + 6 = 0$$

$$\Rightarrow 0 - 0 + \underline{k^2 - 7k + 6} = 0$$

$$\Rightarrow k^2 - 7k + 6 = 0$$

$$\Rightarrow \underline{k^2 - 6k} - \underline{k + 6} = 0$$

$$\Rightarrow k(k-6) - 1(k-6) = 0$$

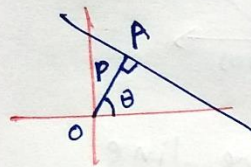
$$\Rightarrow (k-6)(k-1) = 0$$

$$\boxed{k = 6, 1} \checkmark$$

Q.2

$$x \cos \theta + y \sin \theta = p \quad (\text{Normal Form})$$

$$\sqrt{3}x + y + 2 = 0 \quad (\text{Given/General Form})$$



$$\Rightarrow \sqrt{3}x + y = -2$$

$$\Rightarrow -\sqrt{3}x - y = 2$$

~~$\theta = 210^\circ$~~

$$\theta = 210^\circ$$

$$p = 1$$

$$Ax + By + C = 0$$

$$\sqrt{A^2 + B^2} \text{ Divide}$$

$$\text{Divide } \sqrt{(-\sqrt{3})^2 + (-1)^2}$$

$$= \sqrt{3+1} = \sqrt{4}$$

$$= 2 \text{ Divide}$$

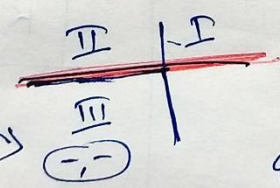
$$\Rightarrow \boxed{-\frac{\sqrt{3}}{2}x - \frac{y}{2} = 1} \quad \text{after dividing '2'}$$

$$x \cos \theta + y \sin \theta = p$$

$$p = 1$$

$$\cos \theta = -\frac{\sqrt{3}}{2}$$

$$\sin \theta = -\frac{1}{2}$$



$$\theta = 180^\circ + 30^\circ$$

$$\theta = 210^\circ$$

Q.3

Sum of intercepts = 1

Product of intercepts = -6

Let x-intercept = a

y-intercept = b

Intercept
Form

$$\frac{x}{a} + \frac{y}{b} = 1$$

ATQ, $a+b=1 \Rightarrow b=1-a$

$$a \cdot b = -6$$

By substitution:

$$\Rightarrow a(1-a) = -6$$

$$\Rightarrow a - a^2 = -6$$

$$\Rightarrow a^2 - a - 6 = 0$$

$$\Rightarrow a^2 - 3a + 2a - 6 = 0$$

$$\Rightarrow a(a-3) + 2(a-3) = 0$$

$$\Rightarrow (a-3)(a+2) = 0$$

$$a=3, a=-2$$

$$b=1-a$$

$$b=1-a$$

$$b=1-3$$

$$\Rightarrow b=1-(-2)$$

$$b=-2$$

$$\Rightarrow b=1+2$$

$$a=3, b=-2$$

$$b=3$$

$$a=-2, b=3$$

line

$$\frac{x}{a} + \frac{y}{b} = 1$$

$$\Rightarrow \frac{x}{3} + \frac{y}{-2} = 1$$

$$\frac{x}{a} + \frac{y}{b} = 1$$

$$\frac{x}{-2} + \frac{y}{3} = 1$$

Q.4

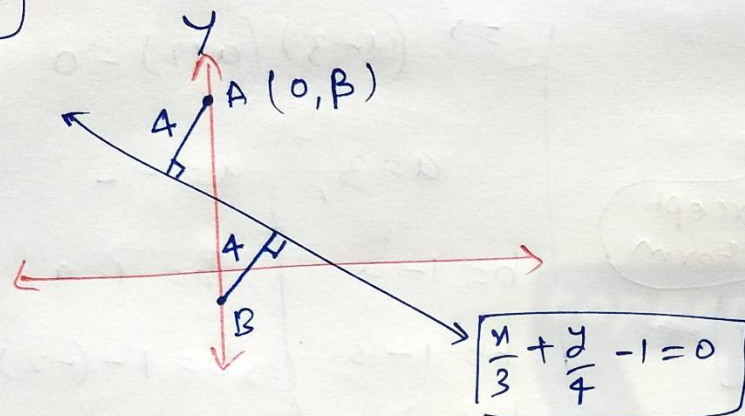


Diagram illustrating the distance d from a point (x_1, y_1) to a line $Ax + By + C = 0$:

$$d = \frac{|Ax_1 + By_1 + C|}{\sqrt{A^2 + B^2}}$$

Let point on y-axis be $(0, \beta)$

ATQ.

By Distance Formula

$$4 = \left| \frac{\frac{0}{3} + \frac{\beta}{4} - 1}{\sqrt{\frac{1}{3^2} + \frac{1}{4^2}}} \right|$$

$$\Rightarrow 4 = \left| \frac{\frac{\beta - 4}{4}}{\sqrt{\frac{16 + 9}{9 \times 16}}} \right|$$

$$\Rightarrow 4 = \left| \frac{\frac{\beta - 4}{4}}{\frac{5}{3 \cdot 4}} \right|$$

$$\Rightarrow 4 = \left| \frac{3(\beta - 4)}{5} \right|$$

$$\Rightarrow 20 = |3\beta - 12|$$

$$3\beta - 12 = 20$$

$$\Rightarrow 3\beta = 32$$

$$\beta = \frac{32}{3}$$

$$3\beta - 12 = -20$$

$$3\beta = -8$$

$$\beta = -\frac{8}{3}$$

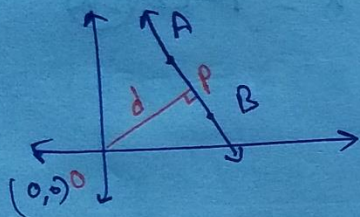
Points $(0, \beta)$

$$\rightarrow \left(0, \frac{32}{3}\right) \text{ and } \left(0, -\frac{8}{3}\right)$$

Q. 5

$$A(\cos\theta, \sin\theta)$$

$$B(\cos\phi, \sin\phi)$$



Equation of AB (Two Point Form)

$$(y - \sin\theta) = \left(\frac{\sin\theta - \sin\phi}{\cos\theta - \cos\phi} \right) \cdot (x - \cos\theta)$$

$$\begin{aligned} \Rightarrow y(\cos\theta - \cos\phi) - \cancel{\sin\theta \cdot \cos\theta} + \sin\theta \cdot \cos\phi \\ = x(\sin\theta - \sin\phi) - \cancel{\sin\theta \cdot \cos\theta} + \sin\phi \cdot \cos\theta \end{aligned}$$

$$\begin{aligned} \Rightarrow -x(\sin\theta - \sin\phi) + y(\cos\theta - \cos\phi) \\ + \sin\theta \cdot \cos\phi - \sin\phi \cdot \cos\theta = 0 \end{aligned}$$

$$\sin A \cdot \cos B - \sin B \cdot \cos A = \sin(A - B)$$

$$\Rightarrow -x(\sin\theta - \sin\phi) + y(\cos\theta - \cos\phi) + \sin(\theta - \phi) = 0$$

AB

Distance b/w (0,0) & AB

$$d = \left| \frac{0 + 0 + \sin(\theta - \phi)}{\sqrt{(-\sin\theta + \sin\phi)^2 + (\cos\theta - \cos\phi)^2}} \right|$$

$$d = \left| \frac{\sin(\theta - \phi)}{\sqrt{\sin^2\phi + \sin^2\theta - 2\sin\theta\sin\phi + \cos^2\theta + \cos^2\phi - 2\cos\theta\cos\phi}} \right|$$

$$d = \left| \frac{\sin(\theta - \phi)}{\sqrt{2 - 2(\sin\theta \cdot \sin\phi + \cos\theta \cdot \cos\phi)}} \right|$$

$$d = \left| \frac{\sin(\theta - \phi)}{\sqrt{2\{1 - \cos(\theta - \phi)\}}} \right|$$

$$d = \left| \frac{\sin(\theta - \phi)}{\sqrt{2 \cdot \left\{ \frac{2 \sin^2(\frac{\theta - \phi}{2}) \right\}}} \right|$$

$$d = \left| \frac{\sin(\theta - \phi)}{2 \sin\left(\frac{\theta - \phi}{2}\right)} \right| \checkmark$$

* $\cos A \cos B + \sin A \sin B = \cos(A - B)$

$$\cos 2x = \cos^2 x - \sin^2 x$$

$$\cos 2x = 1 - 2\sin^2 x$$

$$2\sin^2 x = 1 - \cos 2x$$

Q.6

Point of intersection
of $x - 7y + 5 = 0$ &

$3x + y = 0$

$y = -3x$

By Substitution

$x - 7(-3x) + 5 = 0$

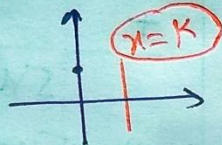
$x + 21x + 5 = 0$

$22x = -5$

$x = -\frac{5}{22}$

$\therefore y = \frac{15}{22}$

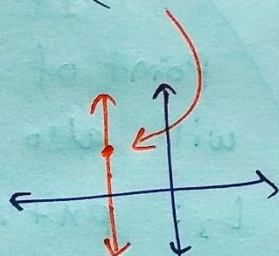
|| to y-axis



Vertical

Point of
intersection

$(-\frac{5}{22}, \frac{15}{22})$

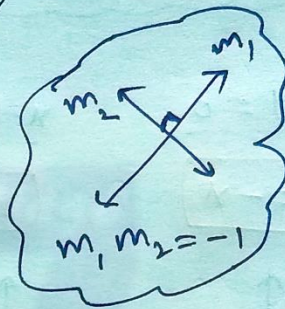


$x = -\frac{5}{22}$

Q.7

Perpendicular
to $\frac{x}{4} + \frac{y}{6} = 1$

Slope = m_1



Newline $\rightarrow$ Slope = m_2

$\frac{x}{4} + \frac{y}{6} = 1$

$\Rightarrow \frac{y}{6} = -\frac{x}{4} + 1$

$\Rightarrow y = -\frac{6x}{4} + 6$

$\Rightarrow y = (-\frac{3}{2})x + 6$

$y = m_1x + c$

$m_1 = -\frac{3}{2}$

Point

where it meets
y-axis

$\rightarrow$ At y-axis

$x = 0$

$\frac{0}{4} + \frac{y}{6} = 1$

$\Rightarrow y = 6$

Point (0,6)

~~New~~ $m_1 m_2 = -1$

$\Rightarrow (-\frac{3}{2}) \cdot m_2 = +1$

$\Rightarrow m_2 = \frac{2}{3}$

New Line: $m = \frac{2}{3}, (0,6)$

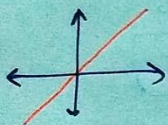
$(y - 6) = (\frac{2}{3}) \cdot (x - 0)$

$\Rightarrow y - 6 = \frac{2x}{3}$

Q.8

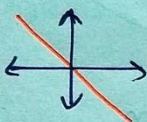
$$y - x = 0$$

$$y = x$$



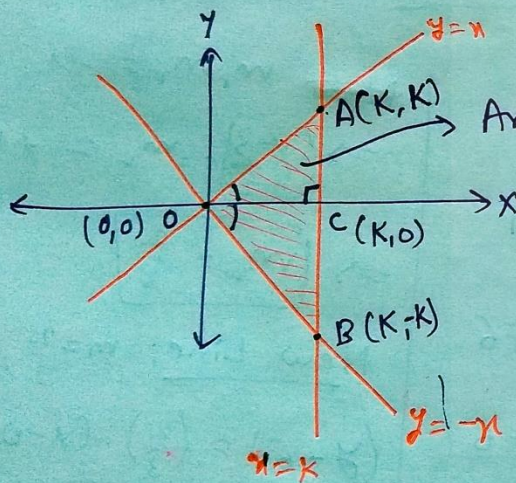
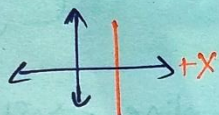
$$x + y = 0$$

$$y = -x$$



$$x - k = 0$$

$$x = k \text{ Vertical}$$



$$\begin{aligned} \text{Area}(\Delta OAC) &= \frac{1}{2} \cdot \text{Base} \times \text{Height} \\ &= \frac{1}{2} \cdot (OC) \cdot (CA) \\ &= \frac{1}{2} \cdot (k) \cdot (k) \\ &= \frac{1}{2} k^2 \end{aligned}$$

$$\begin{aligned} \therefore \text{ar}(\Delta BOA) &= 2 \cdot \text{ar}(\Delta OAC) \\ &= 2 \times \frac{1}{2} \cdot k^2 \\ &= k^2 \end{aligned}$$

Q.9

$$3x + y - 2 = 0 \text{ --- (1)}$$

$$px + 2y - 3 = 0 \text{ --- (3)}$$

$$2x - y - 3 = 0 \text{ --- (2)}$$

+

$$5x - 5 = 0$$

$$\Rightarrow 5x = 5$$

$$\Rightarrow x = 1$$

By eqⁿ. (1):

$$3(1) + y - 2 = 0$$

$$\Rightarrow 1 + y = 0$$

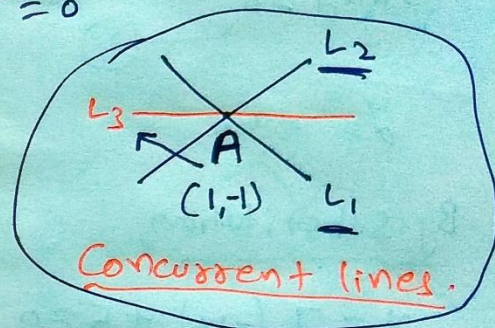
$$\Rightarrow y = -1$$

Point of intersection of L_1 & L_2 will also satisfy the line L_3
 $L_3: px + 2y - 3 = 0$ (1, -1)

$$\Rightarrow p + 2(-1) - 3 = 0$$

$$\Rightarrow p - 5 = 0$$

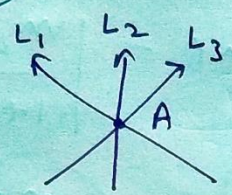
$$\Rightarrow p = 5$$



Q.10

$$y = m_1x + c_1 \text{ --- (1)} \quad y = m_3x + c_3 \text{ --- (3)}$$

$$y = m_2x + c_2 \text{ --- (2)}$$



L_1 & L_2

Point of intersection $(-, -)$ Satisfy (L_3)

$L_1: y = m_1x + c_1 \text{ --- (1)}$

$L_2: y = m_2x + c_2 \text{ --- (2)}$

$$0 = x(m_1 - m_2) + (c_1 - c_2)$$

$$\Rightarrow x(m_1 - m_2) = c_2 - c_1$$

$$\Rightarrow x = \frac{c_2 - c_1}{m_1 - m_2} \checkmark$$

By eqn (1): $y = m_1 \left(\frac{c_2 - c_1}{m_1 - m_2} \right) + c_1$

$$y = \frac{m_1c_2 - m_2c_1 + m_1c_1 - m_2c_1}{m_1 - m_2}$$

$$y = \frac{m_1c_2 - m_2c_1}{m_1 - m_2}$$

Point of intersection of L_1 & $L_2 = \left(\frac{c_2 - c_1}{m_1 - m_2}, \frac{m_1c_2 - m_2c_1}{m_1 - m_2} \right)$

Satisfy $(L_3) \rightarrow y = m_3x + c_3$

$$\Rightarrow \frac{m_1c_2 - m_2c_1}{m_1 - m_2} = m_3 \left(\frac{c_2 - c_1}{m_1 - m_2} \right) + c_3$$

$$\Rightarrow \frac{m_1c_2 - m_2c_1}{m_1 - m_2} = \frac{m_3c_2 - m_3c_1 + m_1c_3 - m_2c_3}{m_1 - m_2}$$

$$\Rightarrow \boxed{m_1(c_2 - c_3) + m_2(c_3 - c_1) + m_3(c_1 - c_2) = 0} \checkmark$$

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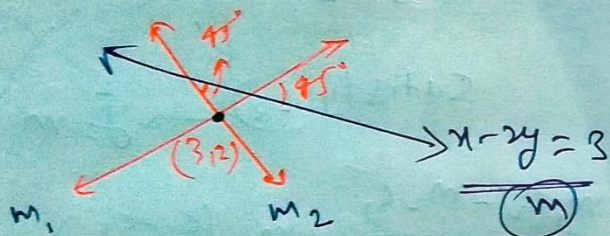
Class-11- Maths straight line.

Miscellaneous Exercise - Chapter 10

Q.11

(3, 2)

45° with
 $x - 2y = 3$



$$x - 2y = 3 \Rightarrow -2y = -x + 3$$

$$\Rightarrow y = \frac{-x}{-2} + \frac{3}{-2}$$

$$\Rightarrow y = \frac{x}{2} - \frac{3}{2}$$

$$y = mx + c$$

$$m = \frac{1}{2}$$

~~Let~~ Angle b/w lines = 45°

$$\tan \theta = \left| \frac{m_2 - m_1}{1 + m_1 m_2} \right|$$

m'

new

$$\frac{m = \frac{1}{2}}{\text{old}}$$

$$\Rightarrow \tan 45^\circ = \left| \frac{m' - \frac{1}{2}}{1 + m' \cdot \left(\frac{1}{2}\right)} \right|$$

$$\Rightarrow 1 = \left| \frac{2m' - 1}{2 + m'} \right|$$

$$\frac{2m' - 1}{2 + m'} = 1$$

$$\Rightarrow 2m' - 1 = 2 + m'$$

$$\Rightarrow m' = 3$$

m_1

$$\frac{2m' - 1}{2 + m'} = -1$$

$$\Rightarrow 2m' - 1 = -2 - m'$$

$$\Rightarrow 3m' = -1 - 2$$

$$\Rightarrow 3m' = -3$$

$$\Rightarrow m' = -\frac{1}{3}$$

m_2

New line,

~~point~~ $(3, 2)$ $m_1 = 3$

$$(y - 2) = (3)(x - 3)$$

$$\Rightarrow y - 2 = 3x - 9$$

$$\Rightarrow \boxed{y = 3x - 7}$$

New line₂ $(3, 2)$, $m_2 = -\frac{1}{3}$

$$(y - 2) = \left(-\frac{1}{3}\right) \cdot (x - 3)$$

$$\Rightarrow 3y - 6 = -x + 3$$

$$\Rightarrow \boxed{x + 3y = 9}$$

Q.12

point of intersection
of $4x + 7y - 3 = 0$ &

$$2x - 3y + 1 = 0$$

$$4x + 7y - 3 = 0$$

$$\begin{array}{r} 4x + 7y - 3 = 0 \\ -4x - 6y + 2 = 0 \\ \hline \end{array}$$

$$13y - 5 = 0$$

$$\boxed{y = \frac{5}{13}}$$

$$2x - 3\left(\frac{5}{13}\right) + 1 = 0$$

$$\Rightarrow 2x = \frac{15}{13} - 1$$

$$\Rightarrow 2x = \frac{2}{13}$$

$$\boxed{x = \frac{1}{13}}$$

point of intersection

$$\left(\frac{1}{13}, \frac{5}{13}\right)$$

Intercept Form $\left(\frac{x}{a} + \frac{y}{b} = 1\right)$

equal intercepts

$$a = b$$

$$\frac{x}{a} + \frac{y}{a} = 1$$

$$\Rightarrow \boxed{x + y = a}$$

$$\left(\frac{1}{13}, \frac{5}{13}\right) \text{ satisfy}$$

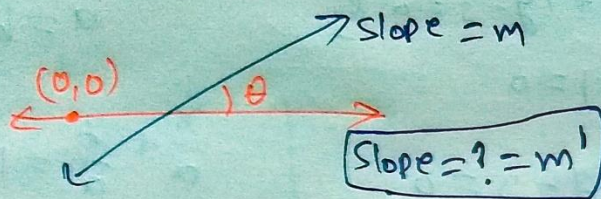
$$\Rightarrow \frac{1}{13} + \frac{5}{13} = a$$

$$\Rightarrow \boxed{\frac{6}{13}} = a$$

$$\boxed{x + y = \frac{6}{13}}$$

Q.13

angle θ with $y = mx + c$, passing through origin $(0,0)$



$$\tan \theta = \left| \frac{m' - m}{1 + m' \cdot m} \right|$$

$$\Rightarrow \frac{m' - m}{(1 + m' \cdot m)} = \pm \tan \theta$$

$$\Rightarrow \underline{m' - m} = \underline{\pm \tan \theta} \pm \underline{m' \cdot m \cdot \tan \theta}$$

$$\Rightarrow \underline{m'} \mp \underline{m' \cdot m \cdot \tan \theta} = m \pm \tan \theta$$

$$\Rightarrow \underline{m'} (1 \mp m \cdot \tan \theta) = m \pm \tan \theta$$

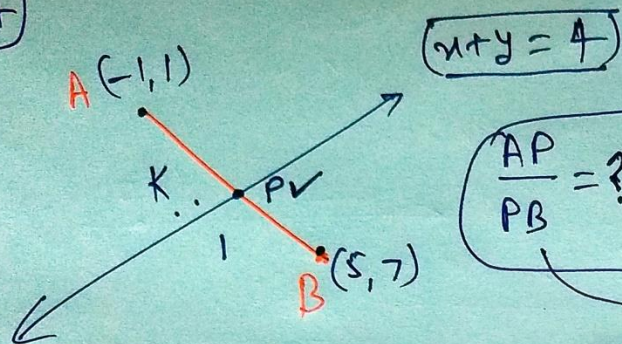
$$m' = \frac{m \pm \tan \theta}{1 \mp m \tan \theta}$$

By point slope form: $(0,0)$

$$(y - 0) = \left(\frac{m \pm \tan \theta}{1 \mp m \tan \theta} \right) \cdot (x - 0)$$

$$\Rightarrow \boxed{\frac{y}{x} = \frac{m \pm \tan \theta}{1 \mp m \tan \theta}}$$

Q.14



$$x+y=4$$

$$\frac{AP}{PB} = ? = \frac{m}{n} = \frac{\left(\frac{3}{5}\right)}{1} = \frac{K}{1} = K$$

Let line $x+y=4$ divides AB in K:1

$$P = ?$$

By Section Formula.

$$P\left(\frac{5K-1}{K+1}, \frac{7K+1}{K+1}\right)$$

$\therefore$ P lies on the line $x+y=4$

$$\Rightarrow \left(\frac{5K-1}{K+1}\right) + \left(\frac{7K+1}{K+1}\right) = 4$$

$$\Rightarrow \frac{12K - \cancel{1} + \cancel{1}}{K+1} = 4$$

$$\frac{3K}{K+1} = 1$$

$$\Rightarrow 3K = K+1$$

$$\Rightarrow 2K = 1$$

$$\Rightarrow \boxed{K = \frac{1}{2}}$$

$$\text{Ratio} = \frac{AP}{PB} = \frac{K}{1} = K = \frac{1}{2}$$

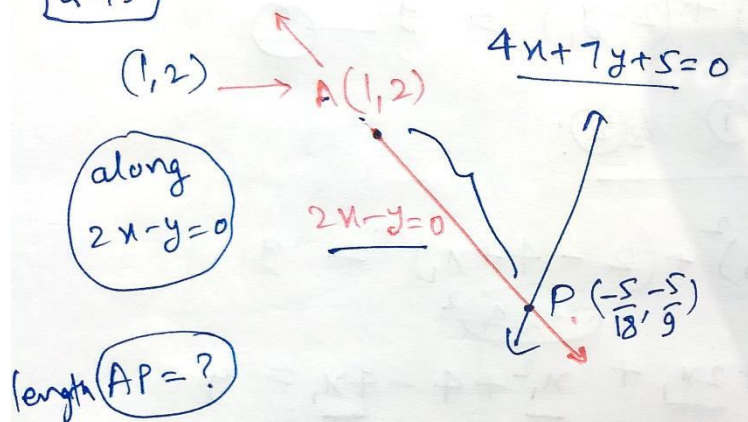
$$\Rightarrow \boxed{1:2}$$

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Class - 11 - Maths Straight Lines

Miscellaneous Exercise - Ch. (10)

Q.15



$$2x - y = 0 \Rightarrow \boxed{y = 2x} \quad \text{--- (1)}$$
$$4x + 7y + 5 = 0 \quad \text{--- (2)}$$

$$\Rightarrow 4x + 7(2x) + 5 = 0$$

$$\Rightarrow 4x + 14x + 5 = 0$$

$$\Rightarrow 18x + 5 = 0$$

$$\Rightarrow \boxed{x = -\frac{5}{18}}$$

$$y = 2x$$

$$y = 2\left(-\frac{5}{18}\right) = -\frac{5}{9}$$

$$P\left(-\frac{5}{18}, -\frac{5}{9}\right) \quad A(1, 2)$$

$$AP = \sqrt{\left(-\frac{5}{18} - 1\right)^2 + \left(-\frac{5}{9} - 2\right)^2}$$

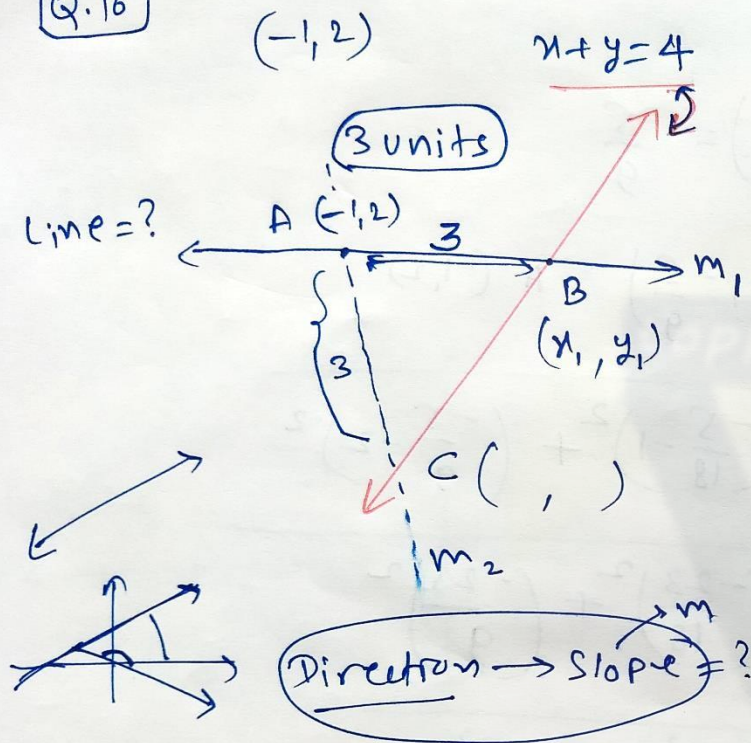
$$AP = \sqrt{\left(-\frac{23}{18}\right)^2 + \left(-\frac{23}{9}\right)^2}$$

$$AP = \sqrt{\frac{23^2}{18^2} + \frac{23^2}{9^2}}$$

$$AP = \frac{23}{9} \sqrt{\frac{1}{4} + 1}$$

$$= \frac{23}{9} \times \sqrt{\frac{5}{4}} = \frac{23\sqrt{5}}{18} \text{ units.}$$

Q.16



Let Point B be (x₁, y₁)

$$x+y=4$$

$$x_1 + y_1 = 4$$

$$\Rightarrow \boxed{y_1 = 4 - x_1} \text{ --- (1)}$$

$$AB = 3$$

$$\Rightarrow \sqrt{(-1-x_1)^2 + (2-y_1)^2} = 3$$

$$\Rightarrow (-1-x_1)^2 + (2-y_1)^2 = 9 \text{ --- (2)}$$

By eqn (1) & (2):

$$\Rightarrow (-1-x_1)^2 + (2-4+x_1)^2 = 9$$

$$\Rightarrow 1 + x_1^2 + 2x_1 + \cancel{2+4} + x_1^2 + 4 - 4x_1 = 9$$

$$\Rightarrow 2x_1^2 - 2x_1 - 4 = 0$$

$$\Rightarrow x_1^2 - x_1 - 2 = 0$$

$$\Rightarrow \underbrace{x_1^2 - 2x_1 + x_1}_{x_1(x_1-2)} - 2 = 0$$

$$\Rightarrow x_1(x_1-2) + 1(x_1-2) = 0$$

$$\Rightarrow (x_1-2)(x_1+1) = 0$$

$$x_1 = 2$$

$$x_1 = -1$$

$$y_1 = 4 - x_1$$

①

$$x_1 = 2$$

$$y_1 = 2$$

$$x_1 = -1$$

$$y_1 = 5$$

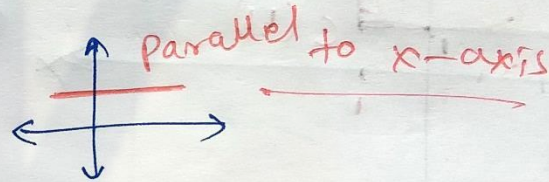
B (2, 2)

C (-1, 5)

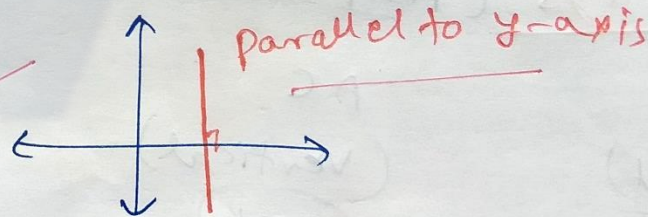
A (-1, 2)

2 - Directions (slopes) are possible

$$m_{AB} = \frac{2-2}{2-(-1)} = \frac{0}{3} = 0$$



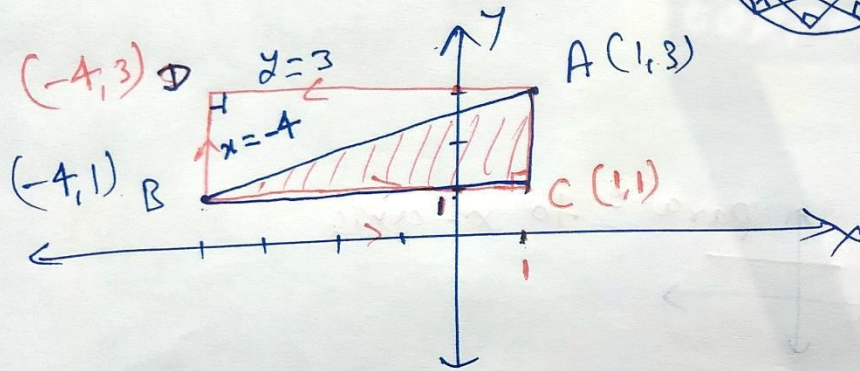
$$m_{AC} = \frac{5-2}{(-1)-2} = \frac{3}{-3} = -1$$



Class-11-Maths.

Miscellaneous Exercise Chapter (10)

Q.17 $A(1,3)$, $B(-4,1)$



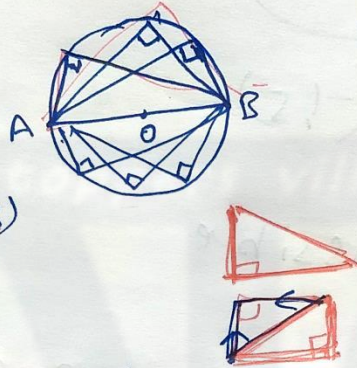
Eq. of legs. (Perpendicular lines)

BC
(Horizontal)
 ~~$y=k$~~

$y=1$

AC
(Vertical)
 $x=k$

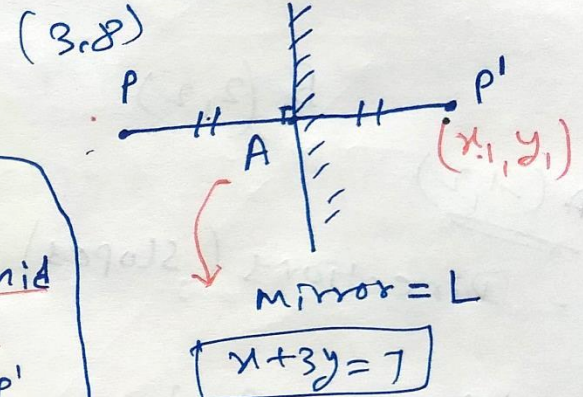
$x=1$



Q.18

$P(3,8)$

mirror
 $x+3y=7$



① A is mid point of PP'

② $L \perp PP'$

$A\left(\frac{3+x_1}{2}, \frac{8+y_1}{2}\right)$ also lies on mirror $x+3y=7$

$$\Rightarrow \frac{3+x_1}{2} + 3\left(\frac{8+y_1}{2}\right) = 7$$

$$\Rightarrow 3+x_1 + 24+3y_1 = 14$$

$$\Rightarrow x_1 + 3y_1 = -13 \quad \text{--- (1)}$$

$$\therefore L \perp PP'$$

$$(m_L) \cdot m_{PP'} = -1$$

$$m_1, m_2 = -1$$

$$\begin{aligned} (L) \\ x + 3y &= 7 \\ 3y &= -x + 7 \\ y &= -\frac{x}{3} + \frac{7}{3} \\ m_L &= -\frac{1}{3} \end{aligned}$$

$$\frac{1}{3} \cdot \left(\frac{y_1 - 8}{x_1 - 3} \right) = 1$$

$$y_1 - 8 = 3x_1 - 9$$

$$y_1 = (3x_1 - 1) \quad \text{--- (2)}$$

$$x_1 + 3y_1 = -13 \quad \text{--- (1)}$$

$$x_1 + 3(3x_1 - 1) = -13$$

$$x_1 + 9x_1 - 3 = -13$$

$$10x_1 = -10$$

$$x_1 = -1$$

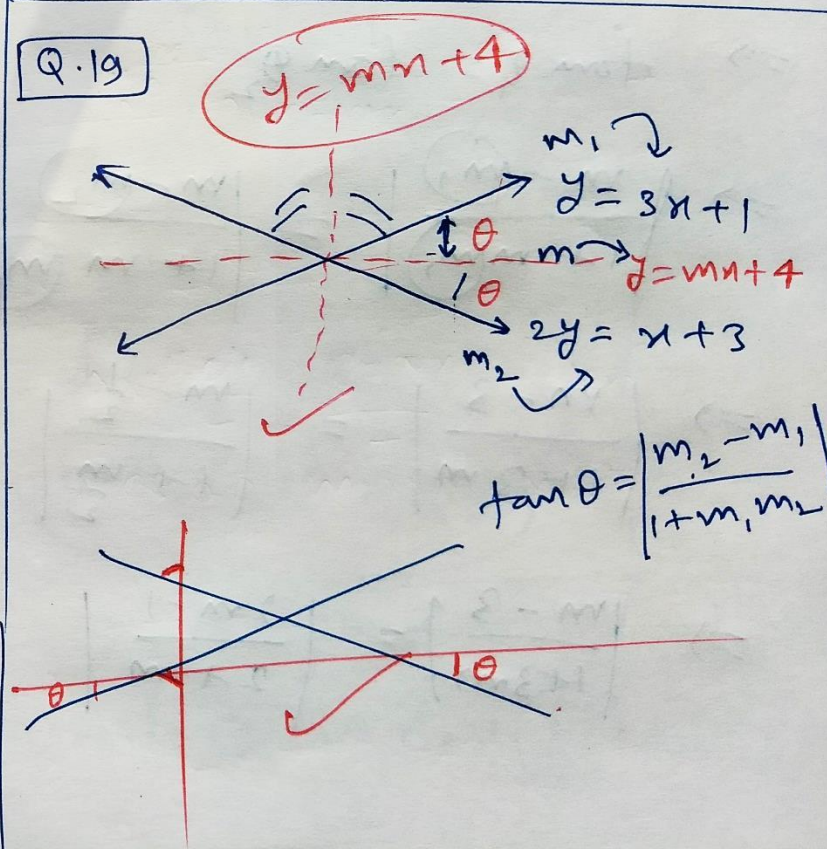
$$\begin{aligned} y_1 &= 3(-1) - 1 \\ y_1 &= -4 \end{aligned}$$

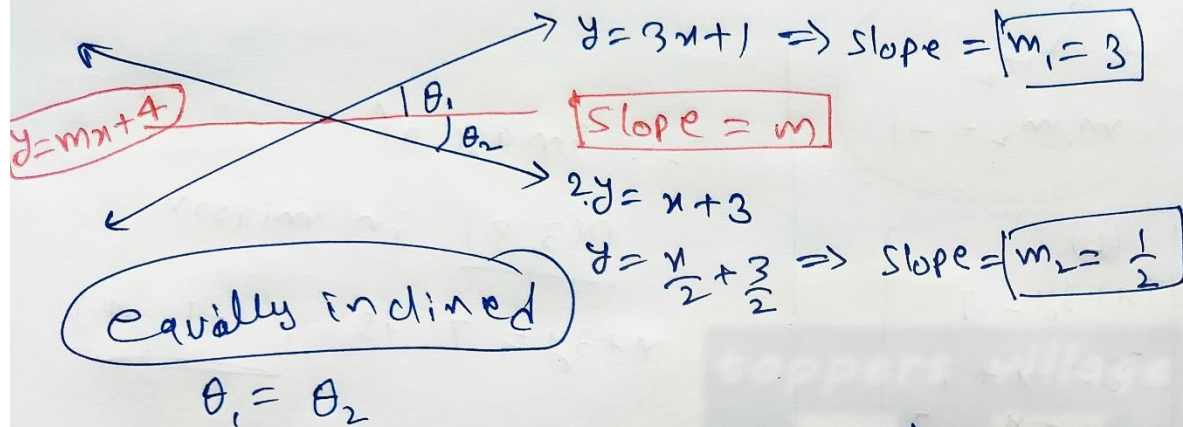
$\therefore$ image of

$P(3, 8)$ in mirror

$x + 3y = 7$ is $P'(-1, -4)$

Q.19





$$|3| = |3| \quad \begin{matrix} -a = b \\ a = -b \end{matrix}$$

$$|3| = |3|$$

$$|-3| = |3|$$

$$|3| = |-3|$$

$$|-3| = |-3|$$

$$\Rightarrow \tan \theta_1 = \tan \theta_2$$

$$\Rightarrow \left| \frac{m - m_1}{1 + m m_1} \right| = \left| \frac{m - m_2}{1 + m m_2} \right|$$

$$\Rightarrow \left| \frac{m - 3}{1 + 3m} \right| = \left| \frac{m - \frac{1}{2}}{1 + \frac{m}{2}} \right|$$

$$\Rightarrow \left| \frac{m - 3}{1 + 3m} \right| = \left| \frac{2m - 1}{2 + m} \right|$$

Case - I

$$\frac{m - 3}{1 + 3m} = \frac{2m - 1}{2 + m}$$

$$\Rightarrow 2m + m^2 - 6 - 3m = 2m - 1 + 6m^2 - 3m$$

$$\Rightarrow -1 = 5m^2$$

$$\Rightarrow m^2 = -1$$

$$\Rightarrow m = \pm \sqrt{-1}$$

Not possible

OR

Case - II

$$\frac{m - 3}{1 + 3m} = -\left(\frac{2m - 1}{2 + m} \right)$$

$$\Rightarrow 2m + m^2 - 6 - 3m = -2m + 1 - 6m^2 + 3m$$

$$\Rightarrow 7m^2 - 2m - 7 = 0$$

$$m = \frac{2 \pm \sqrt{4 + 196}}{14}$$

$$m = \frac{2 \pm \sqrt{200}}{14} = \frac{2 \pm 10\sqrt{2}}{14}$$

Miscellaneous Exercise chapter (10)

Q.20

Sum of Distances from $(x+y-5=0)$
& $(3x-2y+7=0) = 10$

$\downarrow$ $P(x, y)$

$$\left| \frac{x+y-5}{\sqrt{1+1}} \right| + \left| \frac{3x-2y+7}{\sqrt{9+4}} \right| = 10$$

Cases

- | | | | | |
|-------|-----|---|-----|------|
| (I) | (+) | + | (+) | = 10 |
| (II) | (+) | + | (-) | = 10 |
| (III) | (-) | + | (+) | = 10 |
| (IV) | (-) | + | (-) | = 10 |

$\rightarrow |5| + |-5|$
~~100 + 100~~
~~100~~

In first case,

$$\frac{x+y-5}{\sqrt{2}} + \frac{3x-2y+7}{\sqrt{13}} = 10$$

$\rightarrow$ (linear in x & y) line

$\therefore P$ will move on a line

II - case,

$$\frac{x+y-5}{\sqrt{2}} - \left(\frac{3x-2y+7}{\sqrt{13}} \right) = 10$$

$\rightarrow$ (linear in x & y) line

$\therefore P$ will move on a line

Similarly in case (II) & (IV)

[Q. 21]

$$9x + 6y - 7 = 0$$

$$3x + 2y + 6 = 0$$

$$9x + 6y - 7 = 0$$

$$9x + 6y + 18 = 0$$



d_1

d_2



$$9x + 6y + c = 0$$

??

Equidistant

$$d_1 = d_2$$

$$\Rightarrow \left| \frac{-7 - c}{\sqrt{9^2 + 6^2}} \right| = \left| \frac{18 - c}{\sqrt{9^2 + 6^2}} \right|$$

$$\Rightarrow |-7 - c| = |18 - c|$$

$$+(-7 - c) = (18 - c)$$

$$\Rightarrow -7 - c = 18 - c$$

$\Rightarrow$ Not possible

$$-(-7 - c) = (18 - c)$$

$$\Rightarrow 7 + c = 18 - c$$

$$\Rightarrow 2c = 18 - 7$$

$$2c = 11$$

$$c = \frac{11}{2}$$

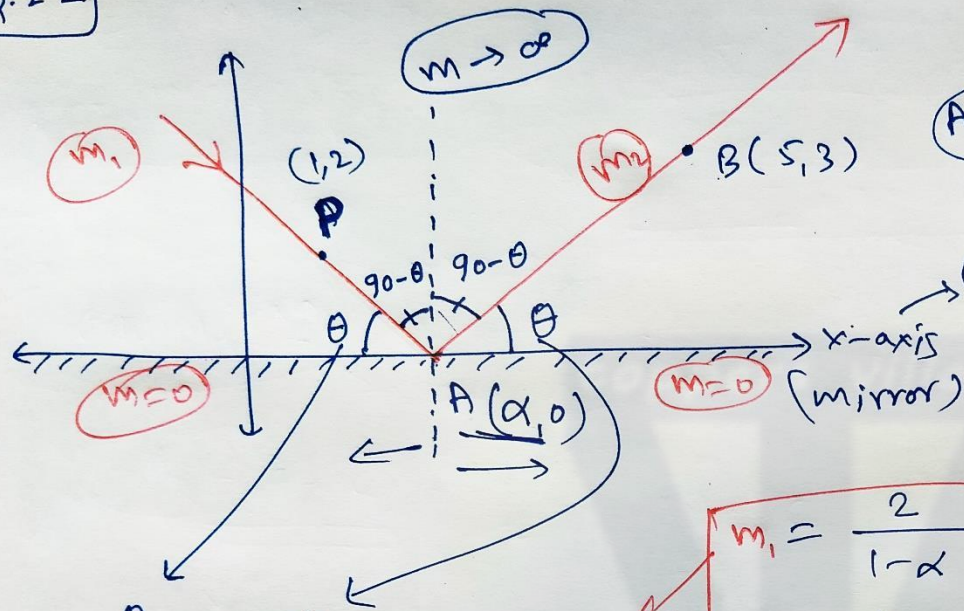
$$\begin{aligned} 3 &= 3 \\ |3| &= |3| \\ |3| &= |-3| \\ |-3| &= |3| \\ |-3| &= |-3| \end{aligned}$$

Required line,

$$9x + 6y + c = 0$$

$$\Rightarrow 9x + 6y + \frac{11}{2} = 0$$

Q.22



Angle of ~~incidence~~ incidence = angle of reflection

Angle b/w two lines.

$$\tan \theta = \left| \frac{m_2 - m_1}{1 + m_1 m_2} \right|$$

$$\Rightarrow \theta = \theta$$

$$\Rightarrow \tan \theta = \tan \theta$$

$$\Rightarrow \left| \frac{m_1 - m_2}{1 + m_1 m_2} \right| = \left| \frac{m_2 - m_1}{1 + m_2 m_1} \right|$$

$$\Rightarrow \left| \frac{2}{1-\alpha} \right| = \left| \frac{3}{5-\alpha} \right|$$

$$m_1 = \frac{2}{1-\alpha}$$

$$m_2 = \frac{3}{5-\alpha}$$

$$m = 0$$

$$\left| \frac{2}{1-\alpha} \right| = \left| \frac{3}{5-\alpha} \right|$$

$$\frac{2}{1-\alpha} = \frac{3}{5-\alpha}$$

$$\Rightarrow 10 - 2\alpha = 3 - 3\alpha$$

$$\Rightarrow \alpha = -7$$

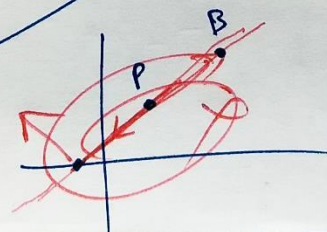
$$\times -7 \notin (1,5)$$

$$\frac{2}{1-\alpha} = -\left(\frac{3}{5-\alpha}\right)$$

$$\Rightarrow 10 - 2\alpha = -3 + 3\alpha$$

$$\Rightarrow 13 = 5\alpha$$

$$\alpha = \frac{13}{5} \in (1,5)$$



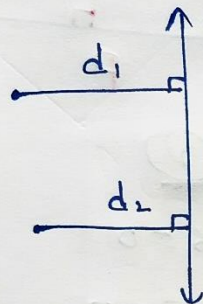
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Miscellaneous Exercise - Chapter 10

Q.23

$$P (\sqrt{a^2 - b^2}, 0)$$

$$Q (-\sqrt{a^2 - b^2}, 0)$$



$$\frac{x}{a} \cos \theta + \frac{y}{b} \sin \theta - 1 = 0$$

$$d_1 = \frac{\left| \frac{\sqrt{a^2 - b^2}}{a} \cos \theta + 0 - 1 \right|}{\sqrt{\frac{\cos^2 \theta}{a^2} + \frac{\sin^2 \theta}{b^2}}} = \frac{\left| \frac{\sqrt{a^2 - b^2}}{a} \cos \theta - 1 \right|}{\sqrt{\frac{\cos^2 \theta}{a^2} + \frac{\sin^2 \theta}{b^2}}}$$

$$d_2 = \frac{\left| -\frac{\sqrt{a^2 - b^2}}{a} \cos \theta - 1 \right|}{\sqrt{\frac{\cos^2 \theta}{a^2} + \frac{\sin^2 \theta}{b^2}}} = \frac{\left| \frac{\sqrt{a^2 - b^2}}{a} \cos \theta + 1 \right|}{\sqrt{\frac{\cos^2 \theta}{a^2} + \frac{\sin^2 \theta}{b^2}}}$$

$$d_1 d_2 = \frac{\left(\left| \frac{\sqrt{a^2 - b^2}}{a} \cos \theta - 1 \right| \times \left| \frac{\sqrt{a^2 - b^2}}{a} \cos \theta + 1 \right| \right)}{\left(\frac{\cos^2 \theta}{a^2} + \frac{\sin^2 \theta}{b^2} \right)}$$

$$= \frac{\left| \frac{(a^2 - b^2) \cos^2 \theta}{a^2} - 1 \right|}{\frac{\cos^2 \theta}{a^2} + \frac{\sin^2 \theta}{b^2}}$$

$$= \frac{\left| \frac{(a^2 - b^2) \cos^2 \theta - a^2}{a^2} \right|}{\frac{\cos^2 \theta}{a^2} + \frac{\sin^2 \theta}{b^2}}$$

$$d_1, d_2 = \left| \frac{(a^2 - b^2) \cos 2\theta - a^2}{a^2} \right|$$

$$\frac{\cos^2 \theta}{a^2} + \frac{\sin^2 \theta}{b^2}$$

$$d_1, d_2 = \left| \frac{a^2 \cos^2 \theta - a^2 - b^2 \cos^2 \theta}{a^2} \right|$$

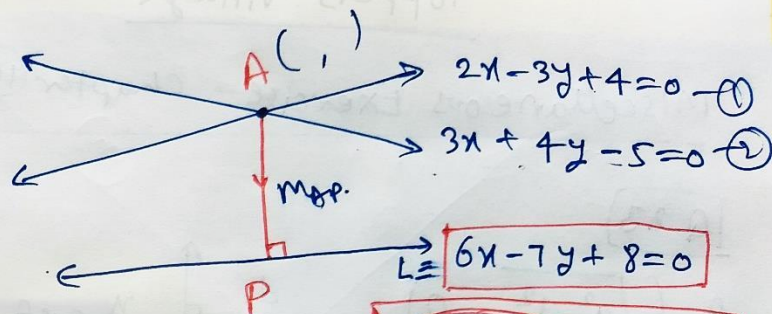
$$\frac{b^2 \cos^2 \theta + a^2 \sin^2 \theta}{a^2 b^2}$$

$$d_1, d_2 = \left| \frac{-\left(\cancel{a^2 \sin^2 \theta} + b^2 \cos^2 \theta\right)}{\cancel{a^2} \cancel{b^2}} \right|$$

$$d_1, d_2 = \left| -b^2 \right|$$

$$\boxed{d_1, d_2 = b^2} \checkmark$$

Q.24



By eqⁿ (1) & (2)

$$8x - 12y + 16 = 0$$

$$9x + 12y - 15 = 0$$

$$+ \quad \quad \quad$$

$$17x + 1 = 0$$

$$\boxed{x = -\frac{1}{17}}$$

By eqⁿ (1):

$$2x - 3y + 4 = 0$$

$$\Rightarrow -\frac{2}{17} - 3y + 4 = 0$$

$$\Rightarrow \frac{-2 + 68}{17} = 3y$$

$$\Rightarrow \boxed{y = \frac{22}{17}}$$

$AP = ?$ → Point (A)

Slope = m_{AP}

$$\left(-\frac{1}{17}, \frac{22}{17} \right)$$

$$A\left(-\frac{1}{17}, \frac{22}{17}\right)$$

$\therefore AP \perp L$

$$\therefore \boxed{m_{AP} \cdot m_L = -1}$$

$$6x - 7y + 8 = 0$$

$$\Rightarrow 7y = 6x + 8$$

$$\Rightarrow y = \left(\frac{6x}{7} + \frac{8}{7} \right)$$

m_L

$$m_L = \frac{6}{7}$$

$$AP \perp L$$

$$\Rightarrow m_{AP} \cdot m_L = -1$$

$$\Rightarrow \boxed{m_{AP} = -\frac{7}{6}} \quad A\left(-\frac{1}{17}, \frac{22}{17}\right)$$

Point Slope Form:

$$(y - y_1) = m(x - x_1)$$

$$\Rightarrow y - \frac{22}{17} = -\frac{7}{6}\left(x - \left(-\frac{1}{17}\right)\right)$$

$$\Rightarrow \frac{17y - 22}{17} = -\frac{7}{6}\left(\frac{17x + 1}{17}\right)$$

$$\Rightarrow 102y - 132 = -119x - 7$$

$$\Rightarrow \boxed{119x + 102y = 125}$$

All Useful Links:

- **YouTube Channel : Toppers Village** (Get full and free video lectures of Class 10 & 11 Maths) - <https://www.youtube.com/toppersvillage>
- **Website :** www.toppersvillage.com
- **Instagram :** <https://www.instagram.com/toppersvillage/>
- **Facebook Page:** www.facebook.com/ToppersVillage/
- **Facebook Group:** <https://www.facebook.com/groups/ToppersVillage>